Forecasting Inflation in Tunisia into instability: Using Dynamic Factors Model a two-step based on Kalman filtering

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A two-step based on Kalman filtering

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Abstract

This work presents a forecasting inflation model using a monthly database. Conventional models for forecasting inflation use a small number of macroeconomic variables. In the context of globalization and dependent economic world, models have to account a large number of information. This model is the goal of recent research in the various industrialized countries as well as developing countries. With Dynamic Factors Model the forecast values are closer to actual inflation than those obtained from conventional models in the short term. In our research we devise the inflation in to “free inflation and administered inflation” and we test the performance of the DFM into instability (before and after revolution) in different types of inflation and trend inflation namely administered and free inflation. We found that dynamic factors model with factor instability leads to substantial forecasting improvements over dynamic factor model without instability factor in period after revolution.

Keywords: Inflation, PCA, VAR, Dynamic Factors Model, Kalman Filter, algorithmic EM, Space-state, forecast.

JEL Classification: E31, C13, C22, C53

Introduction

Inflation defined as the sustainable price increase. It translates into a decrease in the purchasing power attributed to excess liquidity, resulting in an imbalance between supply and demand. Inflation could also lead to a reduction in the external competitiveness of an economy, making its exports relatively more expensive, which can have a negative impact on the balance of trade transactions. Thus, the inflation forecast is a primary concern for policy makers and has been the subject of numerous studies whose objective is to provide a better view of the future evolution of inflation.

However, the current inflation forecast in Tunisia is essentially based on the use of VAR and SARIMA models aggregating monthly data, which anticipate price changes in a relatively short horizon. These models do not consider the international changes in world prices and they are sensitive to the problems of over parameterization (modeling involves too much parameter in an equation system). In attempt to remedy these problems, predictive models were implemented, integrating a large number of detailed and diversified information for reliable forecasts. Among these models, the most famous is the dynamic factor model (DFM). The use of this model for the modeling of inflation in Tunisia can improves the quality of short-term forecasts of this phenomenon.

In this work, we base our work on the model of Stock & Watson, 2002b used for the US economy. Their model is characterized by its performance and its operation, using a large number of data and endless observations taking into account the heteroscedasticity and autocorrelation problems.

To carry out our work we will subdivided the article into four separate sections. In the second section we present the literature review which examined the historical of inflation forecasting and the dynamic factor model. The third section will present the model. The fourth section will present the data. The fifth section will analyse the results of estimation and forecasting. The last and final section concludes the paper.

1. Literature review

It would be important to note that economic forecasting is an estimate for future values of economic variables. Forecasting techniques are used to predict the future evolution of the macroeconomic indices and guide the economic policies towards the desired goal. They appeared for a century with the outbreak of business cycle theory. The forecast has been cultivated in "Havard School". The economic crises in the world before and after World War enriched the studies in this field by Fisher, 1925 and Slutzky, 1937 and Keynes, 1936 and the implementation of the first econometric model by Tinbergen, 1939. Thus, given this importance, economic policymakers have tried to recourse to predictive models to predict future values of economic variables allowing them to plan their future economic strategies.

But what must be noted is that the variable that has taken the most interest among researchers in the field of predictive models is inflation. This can be explained by its complex and composite character.

Thus, various prediction models, have been developed. The difference between them reflected in the information used and the level of over parameterization. Stock & Watson, 1999 combined the forecasting models of inflation into four families: the forecast based on past inflation; the forecast based on the Philips curve; the forecast with the advanced indicator and the forecast with diffusion index.

Phillips, 1958 proposed an estimate between the change in nominal wage rate and the unemployment rate in the UK over the period 1861-1957. He obtained a nonlinear decreasing empirical relationship between the growth rate of nominal wages and the unemployment rate of the form $\boldsymbol{\Delta w_t = a - cU_t + \varepsilon_t}$. This theory is known by its changes through the empirical simplicity. It formed the basis for the dynamic analysis of modern macroeconomics. Phillips, through his theory has generated an important instrument for predicting the short-term inflation and analysis of monetary policy.

The Philips theory has generated incentives to theoreticians to develop its logic based in the the trade-off between employment and inflation. Samuelson & Solow (1960) have shown that the Phillips curve (1958) implies a dilemma between unemployment rate and the inflation both in the short as in the long term.

The Dilemma of Samuelson & Solow, 1960 is based on the Keynesian theory of the labor market and price rigidity which has been criticized by monetarists. Phelps, 1967 and Friedman, 1968 have shown that in the long term, there is no trade-off between inflation and unemployment, and the inflation is a purely monetary phenomenon. The monetary policy of regulation of long-term demand generates only the inflation. This new concept is known under the name of “the Phillips curve increased”. Where Friedman and Phelps have classified the anticipation of the inflation in the short-term analysis. This relationship will be deformed by the evolution of inflation expectations which induces the appearance of a new ‘adaptive anticipation theory’ explaining inflation by an autoregressive process.

In the augmented Phillips curve, wage growth is considered as a function of price. Thus, the causality between prices and wages is represented as a wage fixing phenomenon. This limit has been fixed in the work proposed by Gordon R. J., 1997 and some economists of the

US Federal Reserve such as Fuhrer & Moore, 1995. Gordon, 1997 accorded its delay increased supply shocks and an output gap to the inflation model by an autoregressive process Le-Bihan, 2009. The posterior studies have substituted the unemployment by the gap of output affecting prices.

The market failure is an outcome essentially of the monopolistic competition. The development of economic theory and different schools of thought, participated in the appearance of the new Keynesian school. The Keynesian Phillips curve Version proposed by Gali & Gertler, 1999 is based on the assumption of the following price of revision rule Calvo, 1983. This theory escapes the price fixing assumptions by companies and the presence of rational expectation induced by the monopolistic competition.

Taking account of the macroeconomic forecasting literature, who announces the performance of autoregressive models, Atkeson & Ohanian, 2001 have stated that for the last 15 years, economists failed to produce a version of the Phillips curve that makes a better accurate forecasts of inflation than a naive model (autoregressive) which assume that the inflation during the next four quarters will be equal to the inflation during the last four quarters.

Stock & Watson, 1999 have studied the stability of the Phillips curve in the United States, and the possibility of using other measures of economic activity that are potentially useful for inflation forecasting. They forecast the inflation in the United States during a period of thirty years spread over the period 1959:1 to 1997:9. They found the similar conclusions that were found in the most recent studies of the breaking Phillips curve between 1997and 1998, such as Gordon & Filardo, 1998 and Stock & Watson, 1998. They have proposed an improvement of traditional forecasting methods by the Phillips curve using different economic indicators, in actual fact they have considered 189 indicators. However, the forecast based on these informers cannot improve the Phillips curve forecasting at least in the one-year horizon. The models who add money supply indices to the Phillips curve have made marginal improvements for some sampling periods and measure of inflation driving to a serious deterioration in the accuracy of inflation forecasting based on the CPI during the 70s and the early eighties. The product price does not improve the inflation forecasting over a horizon of 12 months. The measures of overall activity improve the forecasting of the Phillips curve, and the combination of these indices forecasts with the Phillips curve forecasts, produce forecast gains that are statistically and economically significant.

Recent progress in information technology has provided access to thousands of economic time series. This raises the prospect of a new frontier in terms of macroeconomic forecasting using many time series to forecast some indicators of economic conjuncture. The macroeconomic forecasting models currently used are multiple such as the vector autoregressive who combines dozens of variables.

The groupings of these variables, as well as identifying common factors are the subject of the work of Stock & Watson, 2002a.

Stock & Watson, 2002a use an approximate factors model in the aim of replacing the information in the large number of predictors factors by a less factors forecasting. This idea is based on the economic cycle theory cited by Burns, 1950 and the indices of advanced indicators that have been modeled by Thomas, 1977 in their dynamic generalization of the factorial analysis classical model. Their model is used to study the dynamics covariance between sets of variables, Geweke, 1977, Watson & Engel, 1983, Stock and Watson, 1989, Stock and Watson, 1993 and Forni & Reichlin, 1998.

Stock & Watson, 2002a have used 215 time series to build six factors contributed a large part of series variance. They have successfully conducted to some factors that are needed to foresee real activity. This suggests that a very low state vector can be required for forecasts of macroeconomic series. They have faced limits such as the use of calculated indices in the basis of a linear transformation of the data, the use of monthly data (data homogeneity frequency), the use of data from the United States only, the factors estimates are based on simple estimators (without considering heteroscedasticity and serial correlation in the data) and the use of finite data (215).

These limits are solved by Stock & Watson, 2002b by considering a larger number than the number of time-series observation. This dimension of the problem is simplified by modeling the co-variability of the series in terms of a small number of unobserved latent factors. The forecast is realized in two steps; first, the time series of factors will be estimated from the preachers. Second, the relationship between the variable foresees and the factors, will be estimated by a linear regression analysis using the principal components. They concluded that the principal components of the variables compose the estimators of the latent factors.

2. Econometric framework

Our econometric model combines a dynamic factor model with an instability factor to estimate and forecast the inflation rate in Tunisia under instability. More specifically, we use a monthly dynamic factor model to exploit information from a large data. This model provide a estimate of monthly inflation rate. We they apply a principal component analysis to the construct instability monthly factor and obtain an estimate inflation rate under instability. In the following, we describe the econometric model in detail.

2.1.Model

The static factors model can represent the information provided by a large number of variables, $X_t = (x_{1t}, \dots, x_{nt})'$. In the static part we find the exact factors model use a principal component analysis to obtain a vector $F_t = (f_{1t}, \dots, f_{rt})'$.

$$X_t = \Lambda F_t + \varepsilon_t$$

Where $t = 1, \dots, T$. $\varepsilon_t = (\varepsilon_{1t}, \dots, \varepsilon_{nt})'$ is a specific component heteroscedastic residue. Λ is a (n x r) matrix of factor loadings and r denotes the number of factors. The number of factors can be estimated using the method of principal components (nonparametric). Onatski, 2010 has formed a number of static factors test based on the values of $X'X$ number of nonzero Eigen values. Ng and Bai, 2002 proposed a criteria for the choice of the factors in the static frame.

Common shocks and factorial coefficients constitute the common component. The estimated common component requires a linear combination of the series that explains most of the total variance, which amounts to minimize the specific component. So we show a link with OLS, but the problem suppose at the level of common shocks that are not observable, and the number q of common shocks that explain the evolution of the studied variables.

The dynamic factor model has a similar view to the static model with dynamic factor coefficients Forni et all, 2000. In this context we assume a VAR (p) to present the common factors, we have:

$$f_t = \sum_{i=1}^{p} \mathrm{A}_i^0 f_{t-i} + e_t$$

Where the process e_t can have a dynamic (their components are pairwise uncorrelated and uncorrelated with the factors). Then the $VAR(p)$ process can be rewritten in the form of a transformed process F_t satisfying a $VAR(1)$ representation, such as:

$$F_t = AF_{t-1} + \xi_t$$

The estimated parameters of the equation (which represents the dynamic factors) will be obtained through the implementation of an OLS estimator factors (VAR model).

$$\begin{cases} X_t = \Lambda\, F_t + \varepsilon_t \\ F_t = A\, F_{t-i} + B\, e_t \end{cases}$$

The above model admits a state-space representation in which the general form is represented as follows:

$$\begin{cases} X_t = \Lambda F_t + \varepsilon_t & DFM(1) \\ F_t = A F_{t-i} + \xi_t & DFM(2) \end{cases}$$

With :

$$\begin{cases} V(\varepsilon_t) = \Phi = diag(\phi_1, \dots, \phi_n) \\ V(\xi) = \Sigma_\xi \quad (où\ \xi = B\ e_t) \end{cases}$$

The two equations DFM(1) and DFM(2) constitute a state-space model. The first, is a measurement equation that describes the relationship between the observed variable (X_i) and the unobserved state variable (F_t). The second is an equation of state (transition) that describes the process of latent variables (dynamic state vector across the transition matrix A).

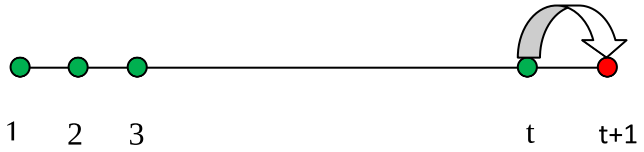
$$\begin{cases} X_t = \Lambda F_t + \varepsilon_t & (M) \\ F_t = A F_{t-1} + \xi_t & (T) \end{cases}$$

The process ε_t and ξ_t are the vector of measurement errors at time t and the innovation vector at time t, respectively. They satisfy the following conditions:

$$\begin{pmatrix} \varepsilon_t \\ \xi_t \end{pmatrix} \approx N\left(0, \begin{pmatrix} R & 0 \\ 0 & Q \end{pmatrix}\right)$$

To obtain the estimates of the factor model parameters, factors will be re-estimated $\hat{F}_t = Proj[F_t | x'_1, \dots, x'_{N+h}]$ by applying the Kalman filter on the state-space model as we define it **(see Appendix 1)**.

To examine the performance of our forecasting models we use the out-sample forecasting (for the forecast date (t + 1) we estimate the models until the date (t), this work refers both N, N = 1/3 of each sample period (each sample period is divided into two sub-periods of a learning and test).



We use the two evaluation criteria of the forecast, MAE (Mean Absolute Error) and RMSE (Root Mean Squared Error).

If $e_t = y_t^p - y_t \,; t = 1, \dots, T$

With, y_t the value of a variable at time t and y_t^p their forecast. e_t is the sequence of forecast errors in the period 1, …, T.

$$MAE = \frac{1}{T}\sum|e_t|$$

$$RMSE = \sqrt{\frac{1}{T}\sum(e_t)^2}$$

3. Data and model selection

3.1.Data

Gross data cover the full period extending from 2000 to 2014. They are collected from general publications, statistical yearbooks of Tunisia, the Tunisian product classification, the nation's accounts, the foreign trade balance Tunisia, annual reports on the characteristics of the agents of the public service and their wages and household consumption statistics available from the National Institute of statistics. Concerning the monetary aggregates data, they are collected from the Central Bank of Tunisia. Finally, data on prices of international commodities are downloaded from the base of the index data Mundi (see **Appendix 2**).

Presentation of gross data: Data collected cover details on consumer prices, industrial selling prices, industrial production, wages, monetary aggregates, the exchange market, foreign trade, energy consumption, public finance, tourism, interest rates, stock market data of Tunisia, global demand, the international prices of some products including beverages, seafood, oils, agricultural commodities, metals, cereals, energy, and fruit. The data also cover the international stock market and international trade (see **Appendix 2** exhaustively detailing the data). So we build a database gathering 121 quantitative variables. This number is consistent with most of the empirical work using this type of model for the prediction of the price index. Seventy-eight percent of these variables relate to the Tunisian economy. The rest is a set of data on international prices.

Firstly, data transformations, most of the data used are index some rates. We transform them into natural logarithm without the rates such as TMM and the foreign exchange market. Secondly, stationary of the series, in relation with the assumptions of the factor model (Stock & Watson, 1998) all explanatory variables must be stationary. To process the stationary of variables, who studies stationary throughout the Dickey-Fuller test. Thirdly, seasonal adjustment, given the specificities of the Tunisian economy as the moving holidays, the Muslim calendar. This process concerns the series from groupings agreed in the previous step. Fourthly, centering and reducing of the series, before starting the principal component analysis, it is important to respect the principles of the CPA. His hypothesis is data normalization. To overcome the effects of scale due to the possible heterogeneity of variables, they are standardized in general.

3.2. Number of factors

In factor models, the number of factor is usually a priori. The principal component analysis is based on the specific variable variance, it allows us to extract a minimum factors accounted for most of the variance (total inertia). In table 1, the percentage of the total variance explained by firstly eighteen principal components is shown:

Table 1 : Percentage of total variance explained by the first 18 static principal components

Number of PCs	1	2	3	...	18
Percentage of total variance explained (%)	9,83	16,70	21,84	...	68,18

The interpretation of the factors, it is a subjective stage, is to determine the combination of variables which is most associated with each factor (see **Appendix 3**).

3.3.Instability factor

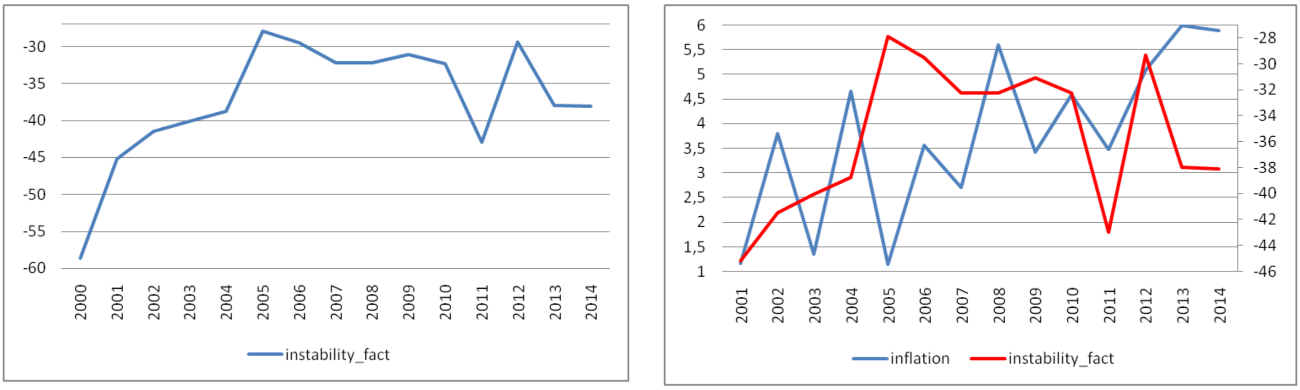
We use POLITY IV[1] data base to construct instability factor from to principal analysis component (see **Appendix 4a**).

Table 2 : Percentage of total variance explained by the first factor

Number of PCs	1
Percentage of total variance explained (%)	69,03

This table below show the instability factor with the curve inflation.

Figure 1: Instability factor vs inflation

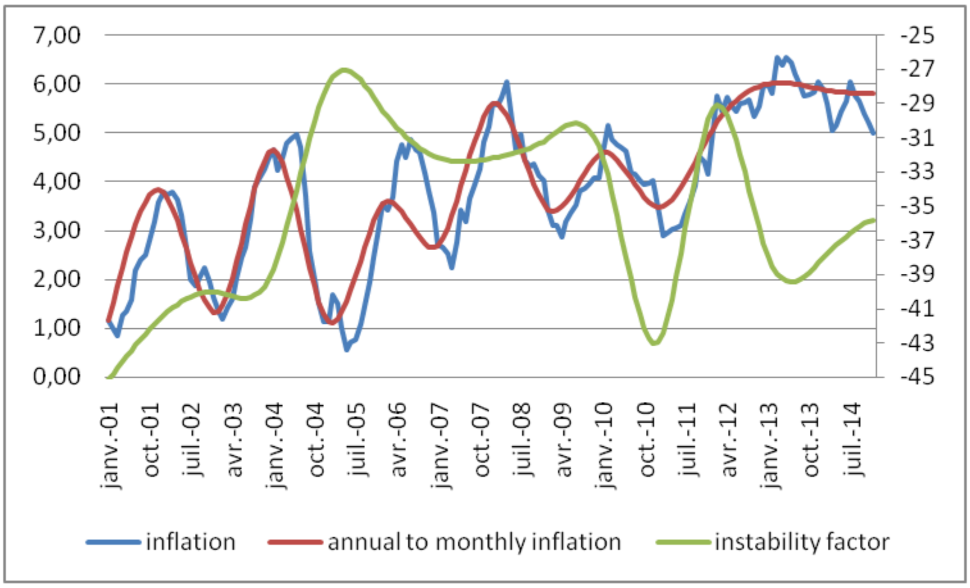


[1] http://www.systemicpeace.org/polityproject.html

The POLICY IV data base is annual frequency; hence the factor of instability construct is annual frequency. We analysis in this paper monthly frequency. Therefore, we use a Low Pass Interpolation[2] to switch from annual to quarterly and monthly frequency.

For more precision, we compare monthly inflation and monthly inflation obtained by low pass filter. We distinguish between the two curves, and we conclude this filter give an acceptable result. The graph below show this difference.

Figure 2: Monthly inflation, monthly inflation low-pass filter and instability factor



3.4.Model estimation

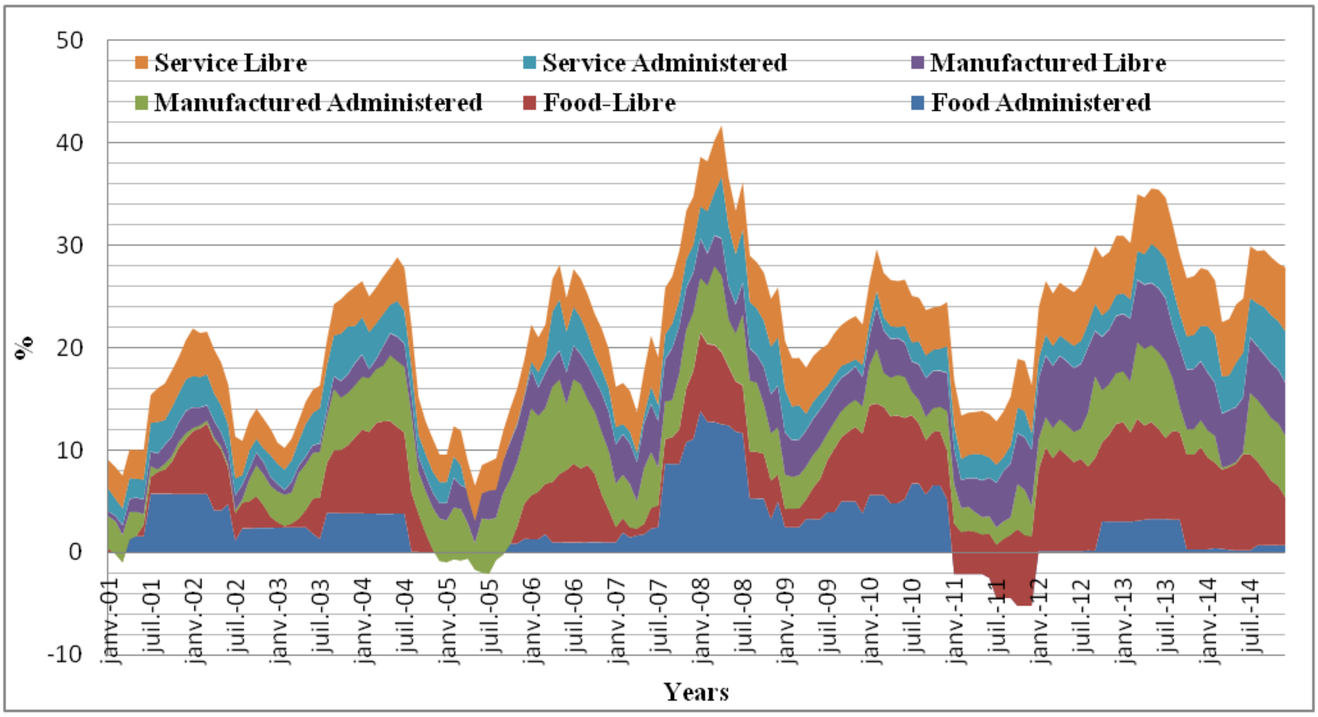
In this section we evaluate the applicability of the dynamic factor model in predicting future values of inflation. Prediction is applied to a variable built in compliance with the following formula:

$$infl_t = \frac{IPC_t - IPC_{t-12}}{IPC_{t-12}}$$

The decomposition of the global year inflation showed a significant effect of the contribution of both the price of fresh food and those of manufactured products. However, the party managed inflation experienced a sharp contraction since January 2011, related to the reduction in prices of commodities at the beginning of the year and maintaining these almost prices unchanged, despite the fiscal burden. In 2013, we see some stabilization of the contribution of fresh food while those of processed and manufactured food products continued to increase as shows the figure below:

[2] Univariate benchmarking and interpolation based on smoothing (via Hodrick-Prescott) and time-domain benchmarking (Denton) (see **Appendix 4b**). (http://www.spatial-econometrics.com/)

Figure 3 : contribution from different inflation types



The PCI consists of 247 products divided on twelve groups[3]. We will extract the indices of 247 products and the weight of the NIS. Then we will classify these products, according to their regime (administered or free) in groups shown in the table 3 below.

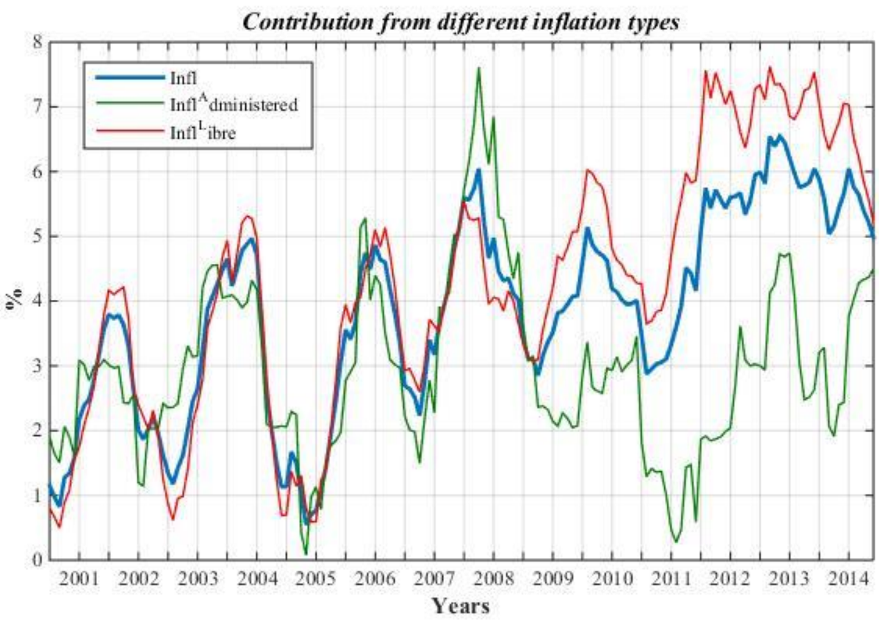
[3] They are: Food and drinks; Tobacco; Clothing and footwear; Housing, water, gas, electricity and other; Furniture, household equipment and routine home maintenance; Health; Transport ; Communications ; Leisure and culture ; Education ; Restaurants and hotels ; Miscellaneous goods and services.

Table 3: Products classification to the regime

Household consumer price index	Household consumer price index Libre	Household consumer price index Administered
Food-Fresh	Food Fresh Libre	Food Fresh Adminisered
Food	Food-Libre	Food Administered
Food-Transformed	Food Transformed Libre	Food Transformed Administered
Manufacturer Construction	Manufacturer Construction Libre	
Manufacturer Maintenance	Manufacturer Maintenance Libre	
Manufacturer Clothing	Manufacturer Clothing Libre	Manufacturer Maintenance Administered
Manufacturer Household	Manufacturer Household Libre	
Other Manufactured	Other Manufacturer Libre	Other Manufacturer Administered
Service Loyer	Service Loyer Libre	Service Loyer Administered
Service Health	Service Health Libre	Service Health Administered
Service Tarif		Service Tarif Administered
Other Service	Other Service Libre	Other Service Administered
Energy	Energy Libre	Energy Administered
Local Tabacco		
Imported Tabacco		

The figure below illustrates the difference between inflation, administered and free inflations. We notice divergence and change in the slope of the curves since middle 2008. This turn is due through structural change in the construction of the consumer price index, (some food products become free). From 2008 the state adopted a market liberalization policy. She begins to remove the compensation on certain products in the CPI, citing for example the tomato, cement, electricity, etc ....

Figure 4: contribution from different inflation types



We analysis and estimate the different types of inflation (total, free and administered) and for more specifically we distinct between inflation and trend inflation. So we present six models:

Model 1: (Total Inflation) : $PCI_t = \alpha_0 + \sum_{i=1}^{18} \alpha_i \, F_t^i + \beta insta_t + \varepsilon_t$,

Model 2: (Administered Inflation): $PCI\_A_t = \alpha_0 + \sum_{i=1}^{18} \alpha_i \, F_t^i \; + \beta insta_t + \varepsilon_t$

Model 3: (Free Inflation): $PCI\_L_t = \alpha_0 + \sum_{i=1}^{18} \alpha_i \, F_t^i + \beta insta_t + \varepsilon_t$

Model 4: (Total trend Inflation) : $t\_PCI_t = \alpha_0 + \sum_{i=1}^{18} \alpha_i \, F_t^i \; + \beta insta_t + \varepsilon_t$,

Model 5: (Administered trend Inflation): $t\_PCI\_A_t = \alpha_0 + \sum_{i=1}^{18} \alpha_i \, F_t^i \; + \beta insta_t + \varepsilon_t$

Model 6: (Free trend Inflation): $t\_PCI\_L_t = \alpha_0 + \sum_{i=1}^{18} \alpha_i \, F_t^i + \beta insta_t + \varepsilon_t$

Our investigate in this paper is determined the effect of instability politics and economics in inflation forecasting. So we subdivided our sample into three periods before 2007, between 2008 and 2010 and after 2011.

First, we proceed to the augmented-Diky-Fullay and Phelips-Peron test for determining the presence of the unit root (see **Appendix 5a**). We use the linear estimation method (OLS). So we check the basic assumptions of the method. Firstly assumption, homocedastic residual based on the breusch-Pagen test (chi2 statistic where the null hypothesis is homocedastic, we accet if the calculated value is grater in absolute value to the tabulated value) (see appendix3b). Secondly assumption, the specification test (Ramsey test, is a Fisher statistic where thee null hypothesis is the model specified, we accepet if the calculated value exceeds the tabular value). Thirdly assumption, Box-Pierce test (Chi2 statistic where the null hypothesis is the absence of residual autocorrelation, we accept this hypothesis if the test value is greater than the tabulated value). Fourthly assumption, Bartlett test, where the null hypothesis is empirical auto-covariance non nullity (see **Appendix 5b**).

4. Result estimations and Forecasting Framework

4.1.Result estimations

We use the GETS method (general to specific). For more specially, Stock and Watson, 2002 haven't interpreted the economic signification of factors. They focus their works on the forecast performance. In this paper, we present same result of economic signification of factors variables and we will proceed to forecast performance.

The time of analysis subdivided on three ample, before structural change in the construction of the consumer price index (2008), after structural change and before revolution (2008-2010) and after revolution (20101).

In the entire sample, the factor model explained 60-80% of the variability explained variable (R^2) for total, administered and free inflation and fore too trend inflation with instability factor and without.

The instability factor has a negative and significant effect in type of inflation (total, free and trend) before 2008. This factor hasn't any effect of administered inflation because it's fixed by State (government). However, this factor has a negative and non significant effect in the all type of inflation after 2008 (under instability). This result impressed by the structural change in the slope of curve inflation, administered inflation and free inflation.

The post revolution period where a listed prices free property know a rising trend usually due to political instability and non state supervision and market development mostly black with Libya in this framework the instability factor has a significantly negative impact on the prices of assets free. On the other hand, the basket of administered assets continued this downward trend through the migration of certain items to the basket and the free state policy after the revolution not hit well administered (usually the goods of first necessity) the instability in this part affects positively the change in the index.

The other factors, according to our nomination, are economically significant. Forni et al, 2005 ; Hallina and Liškaa, 2007 ; Doz et al, 2011 have used those factors for forecasting and they do not interpret the economic significance of factors. Also we focus on the work of the forecast performance.

4.2.Result Forecasting

The Figure 5 below presents the results for the evaluation of the accuracy of predictions at different horizons (h={1, 3, 6 and 12}). Results are expressed in terms of Mean Absolute Error (MAE) and Root Mean Squared Errors (RMSE) relative to a Dynamic Factor Model with instability factor and no of inflation and trend inflation (total, administered and free). The predictions are produced for previous monthly (backcast), current monthly (nowcast) and one monthly ahead (forecasts). The average MAE and RMSE across horizons is also reported. Beside our instability factor, we describe performance of a period before revolution and period after revolution. A histogram below one indicates an improvement with respect to the forecast dynamic factor model without instability factor in instability period (after revolution). Also, an improvement with respect forecasting trend inflation to the forecasting inflation, and administered to free inflation.

Figure 5: Results for the evaluation of the accuracy of predictions

Figure 5a: Total period

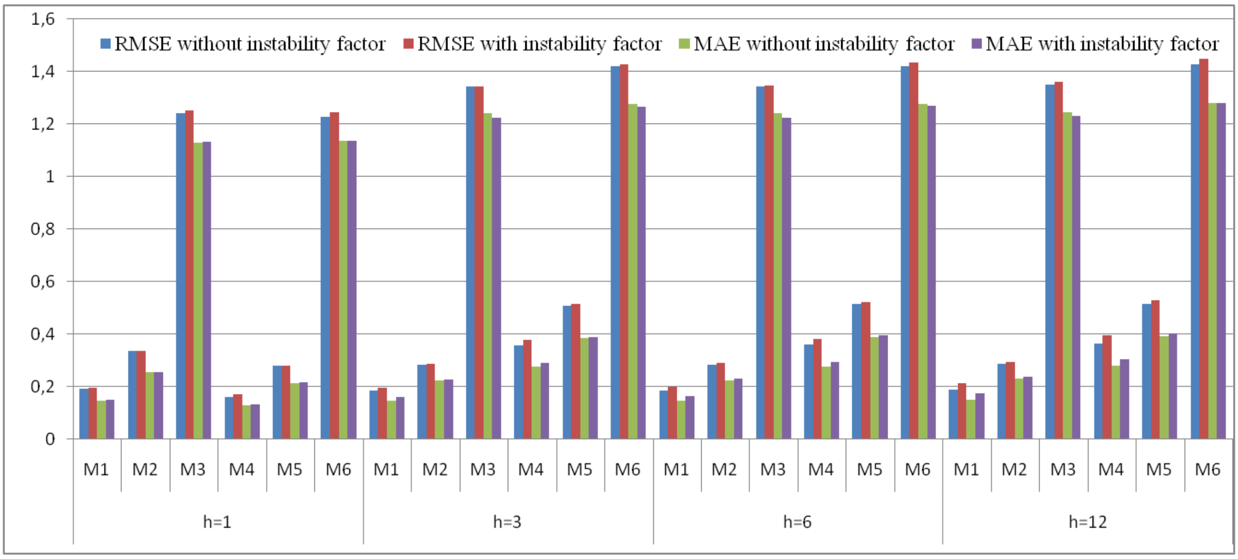


Figure 5b: Period before 2008

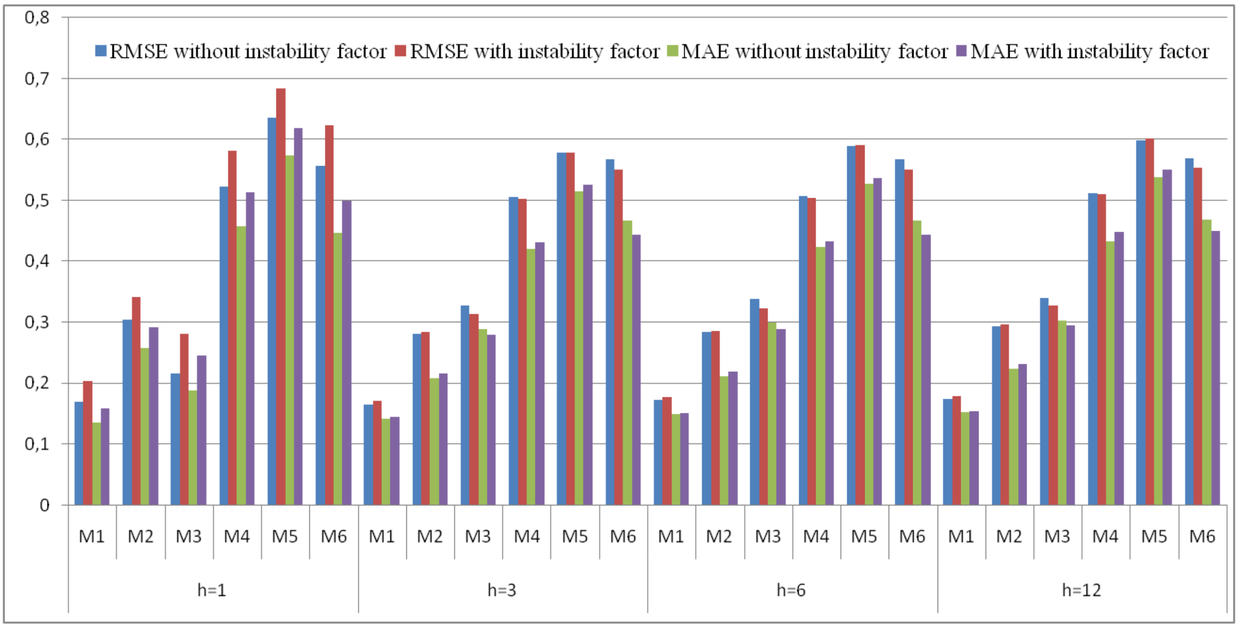


Figure 5c: Period 2008-2010

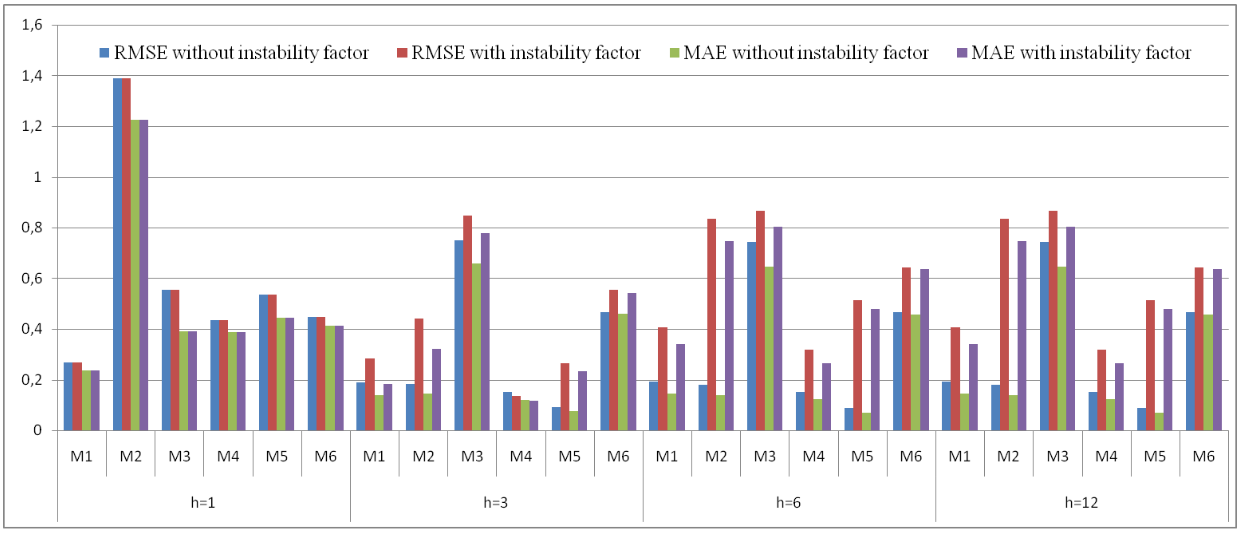
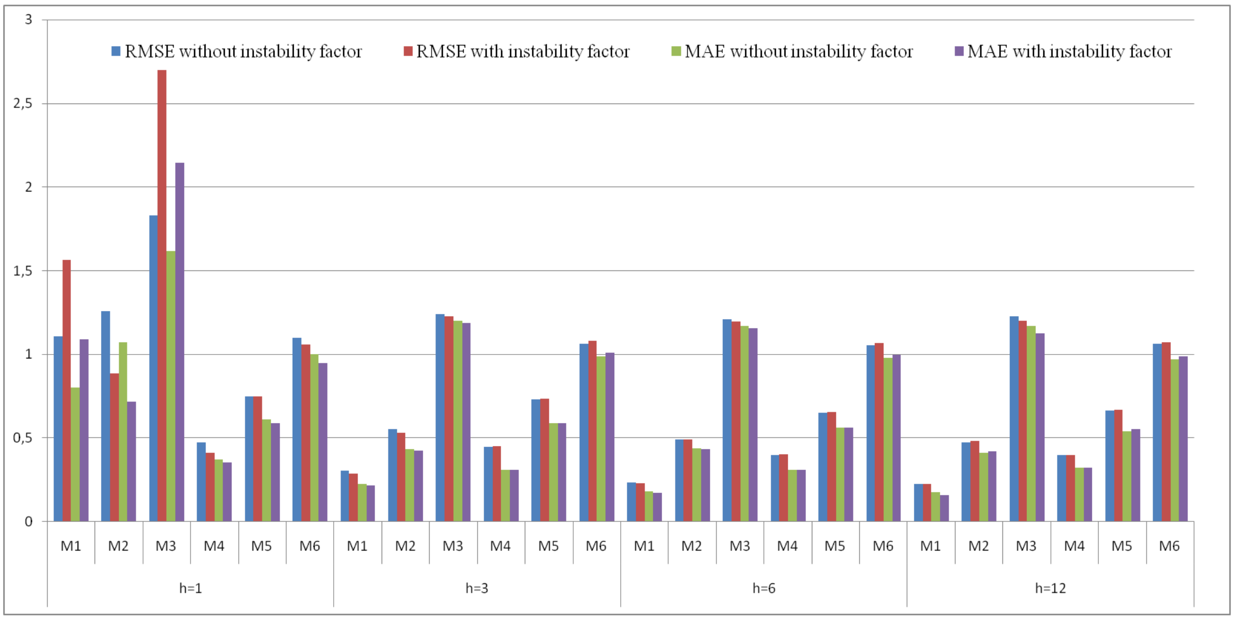


Figure 5d: Period after revolution (2011)



5. Conclusion

This paper has investigated the use of Dynamic Factor Model methods for forecasting inflation in Tunisia into instability. This research proves the importance of factor instability in a Dynamic Factors Model for forecasting total, administered and free inflation before and after revolution. In our empirical work we expose this importance through the use of MAE and RMSE criterion after revolution. The RMSE criterion has shown the performance of DFM of trend inflation notably administered inflation trend.

References

Amengual, D., & Watson, M. W. (2007). Consistent estimation of the number of dynamic factors in a large N and T panel. *Journal of Business and Economic Statistics , 25*, 91-96.

Atkeson, A., & Ohanian, L. E. (2001). Are Phillips Curves Useful for Forecasting Inflation. *Federal Reserve Bank of Minneapolis Quartely Review , 25* (1), 2-11.

Burns, A. F. (1950). *New Facts on Business Cycles.* New York: National Bureau of Economic Research.

Calvo, G. A. (1983). Staggered prices in a utility-maximizing framework. *Journal of Monetary Economics , 12*, 383-398.

Chong, Y. Y., & Hendry, D. F. (1986). Econometric Evaluation of Linear Macro-Economic Models. *The Review of Economic Studies , 53* (4), 671-690.

Doz, C., Giannonec, D., & Reichline, L. (2011). A two-step estimator for large approximate dynamic factor models based on Kalman filtering. *Journal of Econometrics , 164* (1), 188-205.

Fisher, R. A. (1925). Theory of statistical estimation. *Proceedings of the Cambridge Philosophical Society , 22*, 700-725.

Forni, M., & Reichlin, L. (1998). Let's get real: A factor-analytic approach to disaggregated business cycle dynamics. *Review of Economic Studies , 65*, 453-473.

Forni, M., Hallin, M., Lippi, M., & Reichlin, L. (2000). The generalized dynamic factor model: identification and estimation. *The Review of Economics and Statistics , 82* (4), 540-554.

Forni, M., Hallina, M., Lippia, L., & Reichlina, L. (2005). The Generalized Dynamic Factor Model: One-Sided Estimation and Forecasting. *Journal of the American Statistical Association , 100* (471), 830-840.

Friedman, M. (1968). The role of monetary policy. *The American Economic Review , 58* (1), 1-17.

Fuhrer, J., & Moore, G. (1995). Inflation persistence. *The Quartely Journal of Economics , 110* (1), 127-159.

Gali, J., & Gertler, M. (1999). Inflation dynamics: A structural econometric analysis. *Journal of Monetary Economics , 44*, 195-222.

Geweke, J. (1977). *The dynamic factor analysis of economic time series.* (D. A. Goldberger, Éd.) Amesterdam, North-Holland: Latent Variables in Socio Economic Models.

Giannone, D., Reichlin, L., & Sala, L. (2006). VARs factor models and the empirical validation of equilibrium of business cycle models. *Journal of Econometrics , 132*, 257-676.

Gordon, R. J. (1997). The Time-Varying NAIRU and Its Implications for Economic Policy. *Journal of Economic Perspectives , 11* (1), 11-32.

Gordon, S. F., & Filardo, A. J. (1998). Business cycle durations. *Journal of Econometrics , 85* (1), 99-123.

Hallina, M., & Liškaa, L. (2007). Determining the Number of Factors in the General Dynamic Factor Model. *Journal of the American Statistical Association , 102* (478), 603-617.

Keynes, J. M. (1936). *The General Theory of Employment, Interest and Money* (éd. 2007). Palgrave Macmillan.

Le-Bihan, H. (2009). 1958-2008, Avatars et enjeux de la Courbe de Phillips. *Revue de l'OFCE* (111), 81-101.

Ng, S., & Bai, J. (2002). Determining the number of factors in approximate factor models. *Econometrica* (70), 191-221.

Onatski, A. (2010). Determining the number of factors from empirical distribution of eigenvalues. *The Review of Economics , 92* (4), 1004-1016.

Phelps, E. S. (1967). Phillips Curves, Expectations of Inflation and Optimal Unemployment over Time. *Economica , 34* (135), 254-281.

Phillips, A. W. (1958). The relation between unemployment and the rate of change of money wage rates in the united kingdom, 1861-1957. *Economica* (55), 283-299.

Samuelson, P. A., & Solow, R. M. (1960). Analytical aspects of anti-inflation policy. *American Economic Review , 50* (2), 177-194.

Slutzky, E. (1937). The Summation of Random Causes as the Source of Cyclic Processes. *Econometrica , 5* (2), 105-146.

Stock, J. H., & Watson, M. W. (1993). *Business Cycles, Indicators and Forecasting* (Vol. University of Chicago). Chicago: National Bureau of Economic Research.

Stock, J. H., & Watson, M. W. (1998). Diffusion Index. *NBER, Working paper* (6702).

Stock, J. H., & Watson, M. W. (1999). Forecasting inflation. *National Bureau of Economic Research, Working Paper* (7023).

Stock, J. H., & Watson, M. w. (2002b). Forecasting using principal components from a large number of predictors. *Journal of the American Statistical Association , 97* (460), 1167-1179.

Stock, J. H., & Watson, M. W. (2002a). Macroeconomic forecasting using diffusion indexes. *American Association Journal of Business & Economic Statistics , 97* (460), 147-162.

Stock, J. H., & Watson, M. W. (1989). New Indexes of Coincident and Leading Economic Indicators. *NBER Macroeconomics Annual* , 351-393.

Thomas, S. J. (1977). The Demand for Money during Hyperinflations under Rational Expectations: I. *International Economic Review , 18* (1), 59-82.

Tinbergen, J. (1939). *Statistical Testing of Business Cycle Theories: Part II: Business Cycles in the United States of America, 1919-1932.* New York: Agaton Press.

Watson, M. W., & Engel, R. F. (1983). Alternative algorithmes for the estimation of dynamic factor, MIMIC and variying cofficient regression models. *Journal of Econometrics , 23*, 385-400.

Appendix –1

We decompose this estimation step in three stages. But before we start, we must initialize the state at time $t = 0$ by F_0 factors are equal to zero and variances of ω_0 tending to infinity.

At time $t = O$, we have $F_0\ et\ \omega_0$.

At time $t = t - 1$. The first step: forecast: we calculate the conditional expectation at time t , knowing that we have the date (t-1).

$$\left|\begin{aligned} \hat{F}_{t|t-1} &= E\left(F_{t|t-1}\right) = E(A_{t-1}F_{t-1}) \\ \widehat{\omega}_{t|t-1} &= E\left(\omega_{t|t-1}\right) = E(\Lambda_{t-1}^2\omega_{t-1} + Q_{t-1}) \end{aligned}\right.$$

The second step: revision

At the time (t = t)

We set $x = x_t$,

$$\vartheta_t = x_t - \Lambda_{t-1}F_{t|t-1}$$

$$V(\vartheta_t) = \Gamma_t = \Lambda_{t-1}^2\omega_{t|t-1} + R_{t-1}$$

ϑ_t: Error (specific innovation to each variable x)

We use ϑ_t and Γ_t to update $F_t$and ω_t.

$$\left|\begin{aligned} F_t &= F_{t|t-1} + \frac{\Lambda_{t-1}\omega_{t|t-1}\vartheta_t}{\Gamma_t} = F_{t|t-1} + K_t\left(x_t - \Lambda F_{t|t-1}\right) \\ K_t &= \omega_{t|t-1}\Lambda'\left(\Lambda\omega_{t|t-1}\Lambda' + R\right)^{-1} \text{ (gain matrix)} \end{aligned}\right.$$

$$\omega_t = \omega_{t|t-1} + \frac{\Lambda_{t-1}^2\omega_{t|t-1}^2}{\Gamma_t} = (I - K_t\Lambda)\omega_{t|t-1}$$

Subsequently:

$$\left|\begin{aligned} F_{t+1|t} &= AF_{t|t} \\ \omega_{t+1|t} &= A\omega_{t|t}A' + Q \end{aligned}\right.$$

The third step: parameter estimation.

$$L_j = -\frac{1}{2}\sum \vartheta'\Gamma\vartheta - \ln(2\pi)^{\frac{n}{2}}(|\Gamma|)^{\frac{1}{2}} = -\frac{1}{2}\ln\Gamma_t - \frac{1}{2}\frac{\vartheta_t^2}{\Gamma_t}$$

$$Loglik = \sum L_j = -\frac{1}{2}\sum \ln\Gamma_t - \frac{1}{2}\sum\frac{\vartheta_t^2}{\Gamma_t}$$

We move to the time (t = t + 1) and we repeat this three-step procedure until the period T. To refine the estimate of the states, we use the smoothing algorithm. We iterate calculates of the backward for (t = T-1 to 1).

$$\begin{cases} F_{t|T} = F_{t|t} + \omega_{t|t} A' \omega_{t+1|t}^{-1} \left(F_{t+1|T} - F_{t+1|t} \right) \\ \omega_{t|T} = \omega_{t|t} + \omega_{t|t} A' \omega_{t+1|t}^{-1} \left(\omega_{t+1|T} - \omega_{t+1|t} \right) \left(\omega_{t|t} A' \omega_{t+1|t}^{-1} \right)' \end{cases}$$

Factors estimated by the Kalman filter are as follows:

$$F_{Kal} = F_{t|T}$$

Appendix –2

Label	Type	Source	Code	Duration	Variabls Nb	ADF Test
National					100	
Household consumer price index	Index (base 100=2005)	CBT		01-2000 To 12-2014	28	
Administered Food			PCI1			1
Adminisered Fresh			PCI2			1
Energy Administered			PCI27			1
Energy Libre			PCI28			1
Household consumer price index Administered			PCI31			1
Household consumer price index Libre			PCI32			1
Manufacturer Food Libre			PCI42			1
Manufactured Service Libre			PCI44			1
Manufactured Administered			PCI45			1
Other Manufactured Administered			PCI47			1
Other Manufactured Libre			PCI48			1
Manufacturer Maintenance Administered			PCI51			1
Manufacturer Maintenance Libre			PCI52			1
Manufacturer Clothing Libre			PCI53			1
Manufactured Libre			PCI54			1
Manufacturer Household Libre			PCI55			1
Service Administered			PCI73			1
Other Service Administered			PCI75			1
Other Service Libre			PCI76			1
Service Libre			PCI78			1
Service Loyer			PCI79			1
Service Loyer Libre			PCI81			1
Service Health Administered			PCI83			1
Service Health Libre			PCI84			1
Service Tarif			PCI85			1
Service Loyer Libre			PCI88			1
Local Tabacco			PCI101			1
Imported Tabacco			PCI102			1
Industrial production index (per branch)	Index (base 100=2000)	NIST		01-2000 To 09-2014	8	
Agri-food ind			IPI1			1

Construction materials Ceramic and Glass			IPI2			1
Mechanical and electrical industries			IPI3			1
Chemical industries			IPI4			1
Textile, apparel and leather			IPI5			1
Miscellaneous manufacturing industries			IPI6			1
MINING			IPI7			1
ENERGY			IPI8			1
Industrial selling price index (per branch)	Index (base 100=2000)	NIST		01-2000 To 10-2014	8	
Products of Agri-Food Industries			ISPI1			1
Construction Materials, Ceramic and Glass			ISPI2			2
Products of Mechanical and Electrical Industries			ISPI3			1
Chemical Products			ISPI4			1
TEXTILE, APPAREL AND LEATHER			ISPI5			1
Miscellaneous Products of Manufacturing Industries			ISPI6			1
Mining			ISPI7			1
Energy			ISPI8			1
Tourism		CBT			3	
Entries			Tr1	01-2000 To 06-2012		1
Accommodation Days			Tr4	01-2000 To 06-2012		1
Touristic Revenues			Tr5	01-2000 To 06-2012		1
Labor Market		CBT		01-2000 To 01-2012	5	
Guaranteed Minimum Agricultural Wage			Lb1			1
Guaranteed minimum interoccupational wage _40H			Lb2			1
Guaranteed minimum interoccupational wage _48H			Lb3			1
Global demand for employment			Lb4			1
Global offer for employment			Lb5			1
Exports per group of sectors	Million dinars	NIST		01-2000 To 1162014	6	
Agriculture and agri-food industries			Xp1			1
Energy and lubricants			Xp2			1
Mining, phosphates and derivatives			Xp3			1
Textile, apparel and leather			Xp4			1
Mechanical and electrical industries			Xp5			1
Other manufacturing industries			Xp6			1
Imports per group of sectors	Million dinars	NIST		01-2000 To 1162014	6	
Agriculture and agri-food industries			Mp1			1
Energy and lubricants			Mp2			2
Mining, phosphates and derivatives			Mp3			2
Textile, apparel and leather			Mp4			1
Mechanical and electrical industries			Mp5			1
Other manufacturing industries			Mp6			1
Eléctricity consumption	10^6kw/h	CBT			3	
Eléctricity consumption high voltage			El2	01-2000 To 03-2012		1
Eléctricity consumption Medium voltage			El3	01-2000 To 03-2012		1
Eléctricity consumption Low voltage			El4	01-2000 To 01-2012		1
Energy Production		CBT			5	

National Electricity Production				Ep3	01-2000 To 06-2012		1
Mouvement of the Earth				Ep4	01-2000 To 07-2012		1
Extraction				Ep5	01-2000 To 07-2012		1
Phosfat Production				Ep6	01-2000 To 07-2012		1
Local cement Sales				Ep7	01-2000 To 10-2011		1
Transport		Enteger	CBT			2	
Maritime Transport Number				Tr_m	01-2000 To 10-2011		1
Arien Transport Number				Tr_a	01-2000 To 06-2012		1
Public Finance			CBT		06-2000 To 05-2012	7	
Tax Revenues	Direct Taxes	Income Taxes		Pf1			1
		Company Taxes		Pf2			1
	Indirect Taxes	Customs Duties		Pf3			1
		Value Added Tax		Pf4			1
		Consumer Taxes		Pf5			1
		Other Indirect Taxes		Pf6			1
Non-Tax Revenues				Pf7			1
INTERBANK MARKET EXCHANGE RATE AVERAGES FOR MONTH			CBT		01-2000 To 11-2014	5	
ALGERIAN DINAR (DZD)		Rates (U 10)		Tc1			1
SAUDI RIYAL (SAR)		Rates (U 10)		Tc2			1
U.S DOLLAR (USD)		Rates (U 1)		Tc5			1
EURO (EUR)		Rates (U 1)		Tc14			1
LIBYAN DINAR (LYD)		Rates (U 1)		Tc15			1
Interest rates		Rates	CBT			3	
Money market average				TMM	01-2000 To 11-2014		1
Savings Remuneration Rate				TRE	01-2000 To 12-2014		1
Key rate of the BCT				TID	01-2000 To 11-2014		1
RESIDENT FINANCIAL SYSTEM COUNTERPARTS		MTD	CBT		01-2000 To 10-2014	4	
Net foreign assets				CSF2			1
Domestic loans				CSF3			1
Financing of the economy				CSF7			1
Credit to the economy				CSF8			1
RESIDENT FINANCIAL SYSTEM RESOURCES			CBT		01-2000 To 11-2014	7	
M4 aggregate				Ag1			1
Money supply M3				Ag2			1
Money supply M2				Ag3			1
Money M1				Ag4			1
Fiduciary money				Ag5			1
Deposits ay the CCP				Ag8			2
Quasi money				Ag9			1
International			Mundi-index		01-2000 To 12-2011	21	
Beverages						2	

Coffee, Arabica Monthly price	Cent USD pound	IM_bcofa	1
Tea Monthly prices	cents US par kilogramme	IM_bth	1
Vegetable oil and protein meal	Dollars US par tonne métrique		2
Olive oil extra virgin Monthly Price		IM_ho	2
Sunflower oil Monthly prices		IM_htour	1
Agricultural commodities			3
Cotton Monthly Price	Cent USD pound	IM_act	2
Harsh Journals Monthly Price	USD cubic meter	IM_ajd	2
Journals flexible, pleasant Monthly Price	USD cubic meter	IM_ajs	0
Metals	USD metric ton		3
Steel Wire Stem Monthly Price		IM_mfa	1
Iron Ore Monthly Price		IM_mmf	1
Aluminum Monthly Price		IM_mal	1
Cereals	USD metric ton		4
Orge Monthly Price		IM_co	1
Wheat Monthly Price		IM_cb	2
Soft red winter wheat Monthly Price		IM_cbr	1
Maize Monthly Price		IM_cm	1
Energy			5
Crude Petroleum Monthly Price	USD barrel	IM_epb	1
Natural Gaz Monthly Price	USD thousand cubic meters of gas	IM_egn	1
Gasoline Monthly Price	USD gallon	IM_ee	2
Crude Petroleum; West Texas Intermediate Monthly Price	USD barrel	IM_epbt	2
Crude Petroleum, Dubaï Fateh Monthly Price	USD barrel	IM_epbd	1
Fruits	Dollars US par tonne métrique		2
Bananas Monthly Price		IM_fb	2
Oranges Monthly Price		IM_fo	0

Appendix –3

Factor	Label
1	Manufacturing industries
2	monetary aggregate
3	Service sector
4	International index
5	taxes
6	Pci energy adminestered
7	resident financial system counterparts
8	Pci tabacco local and imported
9	Ipc manufacturer libre
10	Quasi money

11	pci service administered
12	maritime Transport
13	Oil monthly prices
14	International pleasant price
15	International coffee price
16	Exportation Agri-food industries
17	Productsof agri food industries
18	Pci service administered

Appendix –4a

Appendix –4b

```
function [y,w,x] = low_pass_interpolation(Y,ta,d,sc,lambda);
% PURPOSE: Low-pass interpolation using Hodrick-Prescott and Denton
% ------------------------------------------------------------------------
% SYNTAX: [y,w,x] = low_pass_interpolation(Y,ta,d,sc,lambda);
% ------------------------------------------------------------------------
% OUTPUT: y: nx1 ---> final interpolation
%         w: nx1 ---> intermediate interpolation (low-pass filtering of x)
%         x: nx1 ---> initial interpolation (padding Y with zeros)
% ------------------------------------------------------------------------
% INPUT: Y: Nx1 ---> vector of low frequency data
%        ta: 1x1 type of disaggregation
%            ta=1 ---> sum (flow)
%            ta=2 ---> average (index)
%            ta=3 ---> last element (stock) ---> interpolation
%            ta=4 ---> first element (stock) ---> interpolation
%        d: 1x1 objective function to be minimized: volatility of ...
%            d=0 ---> levels
%            d=1 ---> first differences
%            d=2 ---> second differences
%        sc: 1x1 number of high frequency data points for each low frequency data point
%            sc= 4 ---> annual to quarterly
%            sc=12 ---> annual to monthly
%            sc= 3 ---> quarterly to monthly
%        lambda: 1x1 --> balance between adjustment and smoothness (HP
%        low-pass filter)
% ------------------------------------------------------------------------
% LIBRARY: copylow, hp, denton_uni
% ------------------------------------------------------------------------
% SEE ALSO: bfl, sw
% ------------------------------------------------------------------------
```

Appendix –5 (Estimation)

5a – unit root test

	ADF				PP				
	Level		1er différence		level		1er différence		ran integration
	trend	Trend and cts	trend	trend and cts	trend	trend and cts	trend	trend and cts	
IPC	5.076535	0.867458	-3.167806	-7.676131***	5.942909	0.439344	-8.910789***	-10.39374***	I(1)
IPC_A	1.353841	-2.119936	-12.60273***	-12.73719***	1.320987	-2.230984	-12.60012***	-12.73719***	I(1)
IPC_L	3.303662	1.253543	-1.824880	-3.600977***	7.609516	1.013748	-9.278103***	-11.01311***	I(1)
F1	-1.880005	-1.910857	-7.906749***	-7.970732***	-1.924328	-1.947760	-7.465151***	-7.503532***	I(1)
F2	0.037296	-1.313044	-5.737104***	-5.690813***	-7.175751***	-6.633420***			I(0)
F3	-6.519606***	-6.574567***			-4.931835***	-4.943128***			I(0)
F4	0.806373	0.843106	-5.861725***	-5.962684***	0.951544	1.140048	-5.753604***	-5.836256***	I(1)
F5	-3.147718**	-2.999445	-4.562090***	-4.542030***	-10.80905***	-10.79201***			I(0)
F6	-2.185902	-1.991689	-10.39256***	-10.51223***	-2.303545	-2.339498	-10.28756***	-10.39135***	I(1)
F7	-2.437271	-3.080656	-5.580398***	-5.555923***	-6.863014***	-6.927417***			I(0)
F8	-11.90649***	-11.81283***			-12.06397***	-11.97506***			I(0)
F9	-12.15144***	-12.37462***			-11.78964***	-11.74322***			I(0)

F10	-7.664966***	-7.896577***			-7.664966***	-7.871252***			I(0)
F11	-13.84889***	-14.35119***			-13.84242***	-14.36200***			I(0)
F12	-12.97045***	-13.30976***			-12.97634***	-13.61407***			I(0)
F13	-12.58708***	-13.01869***			-12.78645***	-13.12883***			I(0)
F14	-13.37505***	-13.35993***			-13.36142***	-13.34639***			I(0)
F15	-7.875345***	-7.779061***			-7.929582***	-7.846184***			I(0)
F16	-16.45833***	-16.41229***			-17.02054***	-16.98229***			I(0)
F17	-14.16222***	-14.37026***			-14.14819***	-14.41416***			I(0)
F18	-4.062524***	-4.485502***			-4.072751***	-4.174809***			I(0)
insta_fac_2_1	-3.054107**	-2.692395	-4.335124***	-4.983566***	-3.578157***	-3.083153	-3.307068**	-3.391777*	I(1)

5b – inflation estimation

App1 : without instability factor

App2 : with instability factor

D.PCI	Total sample		Before 2008		Between 2008 and 2010		After 2010	
	App1	App2	App1	App2	App1	App2	App1	App2
D.F1	-,022 [-4,39]***	-,023 [-4,40]***	-,020 [-2,68]***	-,020 [-2,88]***	-,018 [-1,54]	-,018 [-1,55]	-,047 [-3,29]***	-,049 [-3,37]***
F2	-,024 [-3,74]***	-,024 [-3,73]***	-,020 [-2,80]***	-,019 [-2,86]***	-,017 [-1,17]	-,017 [-1,19]	-,024 [-1,39]	-,026 [-1,44]
F3	-,010 [-2,13]**	-,010 [-2,06]**	,0007 [0,12]	,0012034 [0,20]	-,019 [-1,79]*	-,017 [-1,61]	-,009 [-0,72]	-,010 [-0,74]
D.F4	-,001 [-0,32]	-,001 [-0,34]	,0002 [0,03]	-,0005 [-0,08]	-,016 [-1,07]	-,015 [-0,96]	,012 [0,92]	,014 [0,98]
F5	-,007 [-1,04]	-,006 [-1,00]	,0001 [0,01]	,0008 [0,08]	,009 [0,63]	,010 [0,69]	-,00004 [-0,00]	-,0004 [-0,02]
D.F6	,067 [12,18]***	,066 [12,11]***	,048 [6,90]***	,047 [7,04]***	,071 [5,48]***	,072 [5,54]***	,079 [6,62]***	,080 [6,54]***
F7	-,085 [-9,96]***	-,083 [-9,68]***	-,095 [-9,74]***	-,088 [-9,26]***	-,023 [-1,44]	-,027 [-1,62]	-,101 [-3,78]***	-,102 [-3,73]***
F8	,024 [2,65]***	,022 [2,43]**	,012 [0,91]	,008 [0,63]	,021 [0,92]	,025 [1,05]	,046 [1,90]*	,050 [2,02]*
F9	,032 [3,60]***	,032 [3,56]***	,024 [2,42]**	,023 [2,38]**	,059 [3,09]***	,062 [3,17]***	,068 [2,81]***	,070 [2,74]**
F10	-,012 [-1,04]	-,012 [-1,10]	-,034 [-2,15]**	-,035 [-2,36]**	,018 [0,92]	,019 [0,96]	-,026 [-0,91]	-,025 [-0,90]
F11	-,065 [-6,06]***	-,066 [-6,09]***	-,062 [-4,73]***	-,062 [-4,99]***	-,041 [-1,66]	-,042 [-1,72]	-,071 [-1,83]*	-,066 [-1,69]
F12	-,070 [-4,28]***	-,068 [-4,18]***	-,066 [-3,48]***	-,060 [-3,30]***	-,027 [-0,86]	-,027 [-0,87]	-,028 [-0,69]	-,025 [-0,63]
F13	,030 [2,36]**	,029 [2,29]**	,007 [0,44]	-,00006 [-0,00]	,045 [1,17]	,041 [1,05]	,018 [0,43]	,017 [0,40]
F14	-,030 [-2,15]**	-,030 [-2,14]**	-,024 [-1,38]	-,021 [-1,30]	-,006 [-0,24]	-,013 [-0,46]	-,101 [-2,44]**	-,104 [-2,46]**
F15	,0007 [0,03]	-,001 [-0,06]	-,002 [-0,09]	-,012 [-0,52]	-,061 [-1,08]	-,057 [-1,00]	-,116 [-1,97]*	-,121 [-1,89]*
F16	-,080 [-4,75]***	-,079 [-4,66]***	-,065 [-2,98]***	-,064 [-3,06]***	-,064 [-1,78]*	-,068 [-1,86]**	-,055 [-1,20]	-,056 [-1,20]
F17	,095 [5,06]***	,095 [5,08]***	,085 [4,00]***	,086 [4,24]***	,075 [1,39]	,065 [1,19]	,132 [2,60]**	,129 [2,47]**
F18	-,109 [-5,42]***	-,109 [-5,40]***	-,099 [-4,07]***	-,091 [-3,89]***	-,010 [-0,21]	,002 [0,05]	-,094 [-2,07]**	-,091 [-1,98]*
D.insta		-,211 [-0,96]		-,935 [-3,04]***		,559 [0,96]		,291 [0,92]
cts	,358 [24,82]***	,361 [24,48]***	,302 [18,71]***	,324 [19,13]***	,407 [12,35]***	,414 [12,23]***	,462 [10,74]***	,465 [10,21]***
R2	0,753	0.754	0.768	0.793	0.841	0.849	0.874	0.877
Rajust	0,725	0.725	0.713		0.673	0.671		
F	(18, 160) 27,11	(19, 159) 25.7***	(18, 76) 13.99***	(19, 75) 15.18***	(18, 17) 5.01***	(19, 16) 4.77***	(18, 29)21.94***	(19, 28) 19.32***
N	179	179	95	95	36	36	48	48
Breusch-Pagan /	16,09***	18.34***	5.12**	1.05	7.98***	8.06***	0.04	0.01

Cook-Weisberg								
Ramsey test F	(3, 157)2,93**	(3, 156) 2.62*	(3, 73) 1.53	(3, 72) 1.95	(3, 14) 3.57**	(3, 13) 3.17*	0.17	0.29
portmanteau	83,566***	80.723***	88.023***	109.244	234.053***	248.393***	184.495***	198.593

D.PCI_A	Total sample		Before 2008		Between 2008 and 2010		After 2010	
	App1	App2	App1	App2	App1	App2	App1	App2
D.F1	.0263 [3.48]***	.026 [3.46]***	-.004 [-0.43]	-.004 [-0.45]	.044 [2.28]**	.044 [2.21]**	.012 [0.45]	.012 [0.43]
F2	.033 [3.61]***	.033 [3.60]***	.038 [4.11]***	.038 [4.06]***	.033 [1.41]	.033 [1.36]	.017 [0.51]	.017 [0.50]
F3	.029 [4.23]***	.030 [4.23]***	.048 [6.53]***	.048 [6.58]***	.008 [0.50]	.008 [0.50]	.054 [2.24]**	.054 [2.20]**
D.F4	.049 [6.30]***	.049 [6.27]***	.047 [5.25]***	.047 [5.22]***	.035 [1.42]	.035 [1.38]	.042 [1.61]	.043 [1.58]
F5	-.041 [-4.15]***	-.040 [-4.13]***	-.049 [-3.94]***	-.049 [-3.87]***	-.037 [-1.53]	-.037 [-1.47]	-.069 [-2.01]*	-.069 [-1.97]*
D.F6	.066 [8.34]***	.066 [8.28]***	.057 [6.00]***	.056 [5.69]***	.075 [3.61]***	.075 [3.49]***	.071 [3.22]***	.071 [3.17]***
F7	-.037 [-3.05]***	-.037 [-2.96]***	-.073 [-5.77]***	-.070 [-5.32]***	.012 [0.47]	.011 [0.42]	-.057 [-1.18]	-.057 [-1.16]
F8	.032 [2.45]**	.032 [2.35]**	.041 [2.53]**	.038 [2.33]**	-.007 [-0.20]	-.007 [-0.18]	.007 [0.16]	.007 [0.17]
F9	.009 [0.75]	.009 [0.74]	.014 [1.22]	.013 [1.11]	.028 [0.91]	.028 [0.89]	.006 [0.17]	.006 [0.17]
F10	.020 [1.23]	.020 [1.21]	.018 [0.87]	.017 [0.84]	.076 [2.32]**	.076 [2.25]**	-.020 [-0.44]	-.020 [-0.43]
F11	-.043 [-2.77]***	-.043 [-2.77]***	-.073 [-5.11]***	-.073 [-5.27]***	.001 [0.05]	.001 [0.04]	-.023 [-0.40]	-.022 [-0.38]
F12	-.054 [-2.30]**	-.053 [-2.26]**	-.051 [-2.10]**	-.048 [-1.89]*	-.063 [-1.26]	-.063 [-1.22]	-.028 [-0.34]	-.028 [-0.33]
F13	.010 [0.58]	.010 [0.56]	-.006 [-0.31]	-.010 [-0.49]	-.035 [-0.57]	-.035 [-0.56]	-.001 [-0.02]	-.001 [-0.02]
F14	-.031 [-1.54]	-.031 [-1.53]	-.081 [-3.40]***	-.080 [-3.41]***	-.056 [-1.21]	-.056 [-1.16]	.048 [0.67]	.048 [0.65]

F15	-.007 [-0.21]	-.007 [-0.23]	.006 [0.19]	.001 [0.04]	-.038 [-0.42]	-.037 [-0.40]	-.065 [-0.55]	-.066 [-0.55]
F16	-.060 [-2.46]**	-.060 [-2.43]**	-.051 [-1.67]*	-.050 [-1.63]	-.011 [-0.20]	-.012 [-0.20]	-.098 [-1.34]	-.098 [-1.32]
F17	.037 [1.38]	.037 [1.38]	.061 [1.92]*	.062 [1.96]*	-.031 [-0.36]	-.032 [-0.36]	.072 [0.91]	.071 [0.88]
F18	-.120 [-4.12]***	-.120 [-4.10]***	-.110 [-3.32]***	-.105 [-3.13]***	-.061 [-0.83]	-.060 [-0.76]	-.198 [-2.18]**	-.198 [-2.13]**
D.insta		-.088 [-0.28]		-.485 [-1.31]		.078 [0.08]		.035 [0.06]
cts	.252 [12.05]***	.253 [11.82]***	.285 [12.10]***	.296 [12.32]***	.265 [5.05]***	.266 [4.80]***	.159 [2.03]*	.160 [1.99]*
R2	0.606	0.606	0.788	0.792	0.714	0.714	0.681	0.681
Rajust	0.562	0.559			0.412	0.375	0.483	0.465
F	(18, 160) 13.70***	(19, 159) 12.91***	(18, 76) 12.74 ***	(19, 75) 12.04***	(18, 17) 2.36**	(19, 16) 2.11*	(18, 29) 3.45***	(19, 28) 3.15***
N	179	179	95	95	36	36	48	48
Breusch-Pagan / Cook-Weisberg	20.74***	19.46***	1.32	1.81	10.85***	10.50***	2.69*	2.81*
Ramsey test F	15.79	15.68***	13.17***	12.96***	1.95	1.99	21.11***	20.77***
portmanteau	44.711	45.341	34.227	34.010	70.364***	69.542***	44.175	44.095

D.PCI_L	Total sample		Before 2008		Between 2008 and 2010		After 2010	
	App1	App2	App1	App2	App1	App2	App1	App2
D.F1	-.047 [-6.43]***	-.047 [-6.43]***	-.028 [-2.89]***	-.028 [-3.03]***	-.050 [-3.93] ***	-.050 [-4.19]***	-.078 [-3.75]***	-.080 [-3.77]***
F2	-.052 [-5.80]***	-.052 [-5.79]***	-.048 [-5.89]***	-.047 [-6.14]***	-.043 [-2.12]**	-.043 [-2.47]**	-.046 [-1.84]*	-.048 [-1.86]*
F3	-.030 [-4.42}***	-.029 [-4.35]***	-.022 [-2.70]***	-.022 [-2.51]**	-.033 [-2.54]**	-.030 [-2.56]**	-.041 [-2.08]**	-.042 [-2.10]**
D.F4	-.027 [-3.54]***	-.027 [-3.56]***	-.023 [-2.32]**	-.024 [-2.37]**	-.042 [-2.39]**	-.040 [-2.55]**	-.002 [-0.12]	-.0004 [-0.02]

F5	.009 [1.03]	.010 [1.06]	.024 [1.86]*	.025 [2.10]**	.033 [1.69]	.034 [1.88]*	.034 [1.13]	.033 [1.12]
D.F6	.067 [8.70]***	.067 [8.63]***	.044 [4.09]***	.042 [4.10]***	.069 [4.43]***	.071 [4.80]***	.083 [4.08]***	.084 [4.08]***
F7	-.108 [-9.01]***	-.106 [-8.76]***	-.105 [-8.63]***	-.097 [-8.00]***	-.041 [-2.00]*	-.047 [-2.32]**	-.122 [-2.96]***	-.125 [-2.96]***
F8	.020 [1.55]***	.017 [1.36]	-.002 [-0.12]	-.007 [-0.40]	.036 [1.18]	.041 [1.45]	.066 [1.95]*	.071 [2.02]*
F9	.043 [3.45]***	.043 [3.41]***	.029 [2.35]**	.027 [2.23]**	.075 [3.47]***	.078 [3.48]***	.098 [2.96]***	.101 [2.90]***
F10	-.028 [-1.74]*	-.029 [-1.79]*	-.060 [-2.80]***	-.061 [-3.04]***	-.009 [-0.58]	-.008 [-0.53]	-.029 [-0.70]	-.028 [-0.70]
F11	-.076 [-5.03]***	-.077 [-5.05]***	-.056 [-3.80]***	-.056 [-3.80]***	-.062 [-2.14]**	-.064 [-2.25]**	-.096 [-1.75]*	-.088 [-1.58]
F12	-.078 [-3.39]***	-.076 [-3.30]***	-.074 [-3.38]***	-.066 [-3.09]***	-.009 [-0.26]	-.009 [-0.26]	-.028 [-0.42]	-.024 [-0.35]
F13	.040 [2.21]**	.039 [2.14]**	.013 [0.56]	.004 [0.20]	.085 [1.97]*	.079 [1.89]*	.028 [0.48]	.027 [0.45]
F14	-.030 [-1.50]	-.030 [-1.49]	.004 [0.20]	.007 [0.37]	.017 [0.63]	.007 [0.29]	-.176 [-2.82]***	-.180 [-2.81]***
F15	.004 [0.13]	.001 [0.05]	-.007 [-0.19]	-.019 [-0.52]	-.072 [-1.21]	-.067 [-1.18]	-.142 [-1.40]	-.149 [-1.38]
F16	-.090 [-3.78]***	-.088 [-3.70]***	-.072 [-2.15]**	-.070 [-2.17]**	-.091 [-2.15]**	-.096 [-2.44]**	-.034 [-0.53]	-.035 [-0.54]
F17	.1239385[4.68]***	.124 [4.69]***	.098 [2.74]***	.098 [2.80]***	.129 [1.80]*	.115 [1.77]*	.162 [2.29]**	.157 [2.16]**
F18	-.104 [-3.65]***	-.103 [-3.63]***	-.094 [-2.93]***	-.083 [-2.70]***	.015 [0.33]	.033 [0.73]	-.042 [-0.64]	-.037 [-0.56]
D.insta		-.269 [-0.87]		-1.154 [-2.97]***		.799 [1.38]		.418 [0.79]
cts	.412 [20.24]***	.415 [19.97]***	.310 [15.76]***	.337 [16.09]***	.477 [13.46]***	.487 [12.44]***	.612 [9.30]***	.616 [8.80]***
R2	0.725	0.727	0.728	0.754	0.906	0.915	0.840	0.843
Rajust	0.695	0.694						
F	(18, 16) 23.5***	(19, 15) 22.30***	(18, 76)17.8***	(19, 7) 14.78***	(18, 17) 14.15***	(19, 16)11.87***	(18, 29)17.95***	(19, 28)16.70***
N	179	179	95	95	36	36	48	48
Breusch-Pagan / Cook-Weisberg	24.13***	27.67***	0.10	1.42	0.19	0.04	0.26	0.12
Ramsey test F	(3, 157) 3.00**	(3, 156) 3.03**	(3, 73) 1.25	(3, 72) 1.05	(3, 14) 3.41**	(3, 13) 2.77*	(3, 26) 0.28	(3, 25) 0.38
portmanteau	93.270***	86.817***	58.410**	66.880***	204.793***	220.745***	159.231***	172.678***

5c – inflation trend estimation

Trend PCI	Total sample		Before 2008		Between 2008 and 2010		After 2010	
	App1	App2	App1	App2	App1	App2	App1	App2
D.F1	-.0002 [-0.04]	-.0003 [-0.07]	-.002 [-0.27]	-.002 [-0.37]	.001 [0.21]	.001 [0.18]	-.005 [-0.43]	-.006 [-0.46]
F2	.003 [0.50]	.003 [0.52]	.004 [0.58]	.005 [0.78]	.003 [0.30]	.003 [0.28]	.011 [0.82]	.011 [0.77]
F3	.007 [1.61]	.008 [1.65]	.012 [2.01]**	.013 [2.22]**	-.001 [-0.11]	-.0002 [-0.02]	.010 [0.92]	.010 [0.88]
D.F4	.002 [0.53]	.002 [0.48]	.002 [0.41]	.001 [0.26]	-.002 [-0.14]	-.0007 [-0.05]	.013 [1.18]	.013 [1.21]
F5	-.012 [-1.84]*	-.012 [-1.81]*	-.012 [-1.25]	-.011 [-1.32]	.004 [0.26]	.004 [0.31]	.013 [0.88]	.013 [0.85]
D.F6	.024 [3.99]***	.024 [4.00]***	.019 [2.85]**	.018 [2.91]**	.024 [1.32]	.025 [1.38]	.019 [1.94]*	.019 [1.90]*
F7	-.042 [-4.66]***	-.039 [-4.36]***	-.062 [-5.92]***	-.053 [-5.42]***	.010 [0.58]	.006 [0.35]	.001 [0.07]	.001 [0.05]
F8	.015 [1.92]*	.011 [1.38]	.013 [1.11]	.007 [0.70]	-.012 [-0.41]	-.009 [-0.31]	.0005 [0.04]	.001 [0.11]
F9	.007 [0.84]	.006 [0.76]	.003 [0.38]	.001 [0.18]	.027 [1.65]	.029 [1.58]	.021 [1.31]	.022 [1.30]
F10	-.008 [-0.63]	-.009 [-0.76]	-.033 [-2.15]**	-.035 [-2.50]**	.003 [0.26]	.004 [0.34]	-.008 [-0.40]	-.008 [-0.39]
F11	-.036 [-3.41]***	-.036 [-3.47]***	-.033 [-2.98]**	-.033 [-3.36]***	.006 [0.33]	.005 [0.25]	-.046 [-1.68]	-.044 [-1.62]
F12	-.044 [-2.69]**	-.041 [-2.53]**	-.050 [-2.63]***	-.042 [-2.34]**	-.021 [-0.64]	-.022 [-0.65]	.035 [1.01]	.036 [1.02]
F13	.018 [1.52]	.016 [1.37]	-.011 [-0.73]	-.021 [-1.48]	.002 [0.07]	-.001 [-0.03]	.046 [1.29]	.045 [1.27]
F14	-.025 [-1.92]*	-.024 [-1.94]*	-.014 [-0.93]	-.011 [-0.83]	-.013 [-0.54]	-.019 [-0.76]	-.106 [-3.45]**	-.107 [-3.34]**
F15	.035 [1.54]	.030 [1.33]	.015 [0.58]	.001 [0.07]	-.047 [-1.07]	-.043 [-0.95]	-.039 [-0.99]	-.040 [-0.96]
F16	-.035 [-2.13]**	-.032 [-1.95]*	-.019 [-0.89]	-.017 [-0.88]	.006 [0.16]	.004 [0.09]	-.015 [-0.49]	-.016 [-0.48]
F17	.080 [4.93]***	.080 [4.85]***	.087 [3.99]***	.088 [4.23]***	.050 [0.80]	.041 [0.66]	.072 [2.20]**	.071 [2.11]**
F18	-.115 [-5.82]***	-.115 [-5.82]***	-.118 [-5.15]***	-.106 [-4.94]***	-.067 [-1.48]	-.057 [-1.21]	-.052 [-1.47]	-.050 [-1.37]
D.insta		-.461 [-1.75]*		-1.254 [-4.07]***		.485 [1.19]		.090 [0.28]
cts	.357 [25.68]***	.363 [25.83]***	.291 [17.48]***	.320 [20.18]***	.387 [12.35]***	.393 [12.17]***	.548 [14.62]***	.549 [14.41]***
R2	0.533	0.547	0.611	0.683	0.435	0.460	0.688	0.689
F	(18, 16) 13.73***	(19, 15) 13.51***	(18, 76) 7.81***	(19, 75) 9.58***	(18, 17) 2.10*	(19, 16)2.30***	(18, 29) 11.90***	(19, 28)10.87***
N	179	179	95	95	36	36	48	48
Breusch-Pagan /	2.37	2.59	1.41	0.40	13.66***	11.02***	1.11	1.50

Cook-Weisberg								
Ramsey test F	1.52	(3, 156) 1.35	(3, 73) 1.59	(3, 72) 3.17**	(3, 14) 1.63	(3, 13) 1.22	(3, 26) 0.42	(3, 25) 0.38
portmanteau	172.494***	156.271***	147.258***	212.101***	539.31***	645.800***	425.321***	440.375***

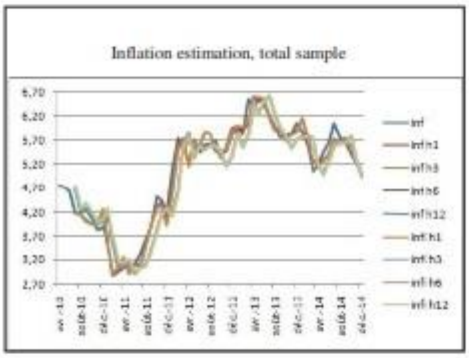
Trend PCI_A	Total sample		Before 2008		Between 2008 and 2010		After 2010	
	App1	App2	App1	App2	App1	App2	App1	App2
D.F1	.001 [0.29]	.001 [0.23]	-.007 [-0.87]	-.007 [-0.90]	.022 [2.16]**	.022 [2.03]*	-.018 [-0.82]	-.018 [-0.83]
F2	.017 [2.40]**	.017 [2.30]**	.014 [1.95]*	.015 [1.98]*	.026 [1.87]*	.026 [1.79]*	-.003 [-0.11]	-.003 [-0.11]
F3	.003 [0.72]	.004 [0.69]	.014 [2.31]**	.015 [2.39]**	-.013 [-0.89]	-.012 [-0.81]	.016 [0.81]	.016 [0.79]
D.F4	.011 [1.82]*	.010 [1.53]	.015 [2.55]**	.014 [2.52]**	.0002 [0.01]	.001 [0.08]	-.0005 [-0.03]	-.0005 [-0.03]
F5	-.018 [-2.42]**	-.018 [-2.38]**	-.019 [-1.71]*	-.018 [-1.70]*	.005 [0.28]	.005 [0.31]	-.028 [-1.12]	-.028 [-1.10]
D.F6	.032 [5.23]***	.031 [4.60]***	.032 [4.77]***	.031 [4.78]***	.032 (1.70]	.033 [1.73]	.026 [1.39]	.026 [1.37]
F7	-.020 [-2.18]**	-.019 [-1.83]*	-.055 [-5.35]***	-.049 [-4.93]***	.040 [2.60]**	.038 [2.24]**	-.013 [-0.31]	-.013 [-0.30]
F8	.030 [2.99]***	.029 [2.91]**	.019 [1.61]	.015 [1.35]	-.008 [-0.29]	-.006 [-0.22]	.015 [0.53]	.015 [0.50]
F9	-.002 [-0.22]	-.002 [-0.26]	.001 [0.19]	.0003 [0.04]	.015 (0.99]	.017 [1.02]	-.007 [-0.23]	-.007 [-0.23]
F10	.027 [2.13]**	.026 [1.66]*	.030 [1.58]	.029 [1.63]	.036 [2.58]**	.037 [2.80]**	.008 [0.20]	.008 [0.19]
F11	-.025 [-2.14]**	-.026 [-1.97]**	-.049 [-3.72]***	-.049 [-4.02]***	.028 [1.30]	.027 [1.22]	-.022 [-0.49]	-.022 [-0.52]
F12	-.041 [-2.30]**	-.040 [-2.13]**	-.041 [-2.15]**	-.035 [-1.84]*	-.065 [-1.76]*	-.066 [-1.75]*	.002 [0.05]	.002 [0.05]
F13	-.004 [-0.32]	-.005 [-0.42]	.007 [0.46]	.0007 [0.05]	-.057 [-1.34]	-.060 [-1.40]	-.008 [-0.13]	-.008 [-0.13]
F14	-.008 [-0.55]	-.008 [-0.49]	-.042 [-2.25]**	-.040 [-2.23]**	-.025 [-0.97]	-.029 [-1.11]	.004 [0.10]	.004 [0.10]
F15	-.041 [-1.58]	-.043 [-1.53]	-.011 [-0.39]	-.019 [-0.75]	-.113 [-2.30]**	-.110 [-2.10]*	-.104 [-0.99]	-.104 [-0.98]
F16	-.066 [-3.52]***	-.065 [-3.07]**	-.025 [-1.28]	-.024 [-1.29]	-.015 [-0.37]	-.017 [-0.40]	-.088 [-1.67]	-.088 [-1.64]
F17	.067 [3.23]***	.067 [2.99]**	.060 [2.69]**	.061 [2.92]**	.022 [0.32]	.015 [0.22]	.1276 [2.16]**	.127 [2.13]**
F18	-.128 [-5.70]***	-.128 [-5.34]***	-.084 [-3.87]***	-.076 [-3.56]***	-.114 [-2.20]**	-.106 [-1.94]*	-.209 [-3.77]***	-.210 [-3.57]***
D.insta		-.182 [-0.73]		-.826 [-2.61]**		.364 [0.89]		-.013 [-0.03]
cts	.254 [15.77]***	.256 [15.13]***	.273 [14.91]***	.292 [15.01]***	.264 [9.12]***	.268 [9.34]***	.206 [3.33]**	.206 [3.38]**
R2	0.378	0.380	0.631	0.660	0.775	0.781	0.446	
F	(18, 16)5.41***	(19, 15) 4.72***	(18, 76) 8.90***	(19, 75) 9.82***	(18, 17) 30.7***	(19, 16) 20.9***	(18, 29) 3.04***	

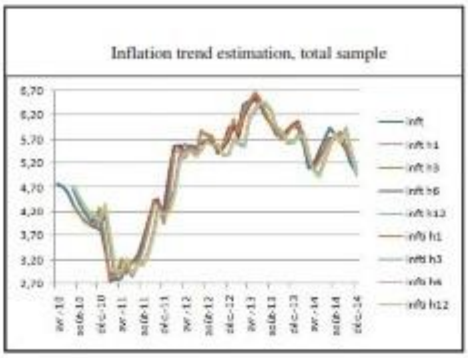
N	179	179	95	95	36	36	48	
Breusch-Pagan / Cook-Weisberg	3.74*	2.22	0.03	0.09	5.32**	4.50**	1.09	1.03
Ramsey test F	(3, 157) 4.62**	(3, 156) 4.66**	(3, 73) 3.98**	(3, 72) 4.65***	(3, 14) 1.06	(3, 13) 1.03	(3, 26) 0.23	(3, 25) 0.24
portmanteau	126.191***	134.987***	98.1765	109.282***	79.816***	80.278***	83.677	83.777***

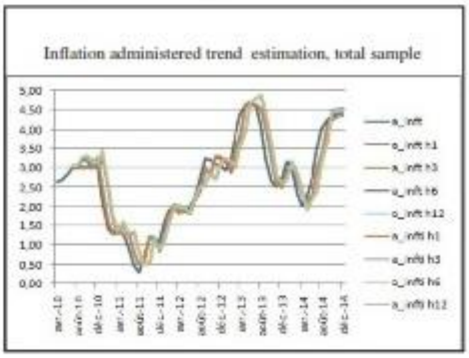
Trend PCI_L	Total sample		Before 2008		Between 2008 and 2010		After 2010	
	App1	App2	App1	App2	App1	App2	App1	App2
D.F1	-.003 [-0.60]	-.003 [-0.65]	-.006 [-0.80]	-.006 [-0.93]	-.005 [-0.74]	-.005 [-0.75]	.004 [0.31]	.004 [0.30]
F2	-.005 [-0.77]	-.005 [-0.75]	-.004 [-0.67]	-.003 [-0.64]	-.004 [-0.42]	-.004 [-0.47]	.018 [1.29]	.018 [1.25]
F3	.006 [1.10]	.006 [1.20]	.003 [0.59]	.004 [0.67]	.0007 [0.06]	.002 [0.19]	.006 [0.53]	.006 [0.52]
D.F4	-.006 [-1.06]	-.006 [-1.14]	-.008 [-1.13]	-.010 [-1.33]	-.001 [-0.09]	.0003 [0.03]	.006 [0.54]	.006 [0.51]
F5	-.012 [-1.56]	-.012 [-1.49]	-.010 [-0.91]	-.009 [-0.96]	.005 [0.42]	.006 [0.49]	.028 [1.65]	.028 [1.62]
D.F6	.012 [1.96]*	.012 [1.89]*	.007 [1.03]	.005 [0.89]	.008 [0.59]	.010 [0.66]	.012 [1.06]	.011 [1.05]
F7	-.049 [-5.29]***	-.046 [-4.95]***	-.063 [-6.40]***	-.053 [-5.95]***	.0002 [0.02]	-.003 [-0.24]	.018 [0.65]	.018 [0.62]
F8	.010 [1.07]	.005 [0.58]	.009 [0.68]	.003 [0.31]	-.001 [-0.08]	.001 [0.06]	-.027 [1.40]	-.027 [-1.36]
F9	.003 [0.30]	.002 [0.22]	.003 [0.30]	.001 [0.11]	.013 [1.10]	.015 [1.17]	.011 [0.57]	.011 [0.55]
F10	-.024 [1.93]*	-.026 [-2.09]**	-.053 [-3.45]***	-.055 [-4.01]***	-.027 [-2.39]**	-.027 [-2.59]**	.003 [0.20]	.003 [0.20]
F11	-.037 [-2.99]**	-.038 [-3.01]**	-.023 [-1.94]*	-.023 [-2.19]**	-.006 [-0.39]	-.008 [-0.48]	-.060 [-2.43]**	-.061 [-2.19]**
F12	-.045 [-2.39]**	-.041 [-2.16]**	-.059 [-2.99]**	-.050 [-2.91]**	.016 [0.60]	.015 [0.60]	.031 [0.77]	.031 [0.75]
F13	.032 [2.25]**	.030 [2.12]**	-.005 [-0.32]	-.016 [-0.98]	.048 [1.45]	.044 [1.30]	.070 [2.66]**	.070 [2.60]**
F14	-.026 [-1.68]*	-.026 [-1.70]*	.004 [0.23]	.007 [0.51]	-.015 [-0.70]	-.021 [-1.00]	-.102 [-2.66]**	-.101 [-2.64]**
F15	.072 [2.48]**	.067 [2.27]**	.024 [0.78]	.010 [0.37]	.011 [0.29]	.014 [0.39]	.009 [0.20]	.010 [0.21]
F16	-.022 [-1.19]	-.019 [-0.99]	-.017 [-0.69]	-.015 [-0.67]	.022 [0.68]	.019 [0.57]	-.001 [-0.04]	-.001 [-0.04]
F17	.076 [3.61]***	.077 [3.53]***	.082 [3.25]**	.083 [3.42]***	.086 [1.77]*	.077 [1.59]	.033 [0.99]	.034 [0.95]
F18	-.104 [-4.69]***	-.103 [-4.74]***	-.111 [-4.29]	-.099 [-4.13]***	-.062 [-1.70]	-.050 [-1.34]	-.004 [-0.10]	-.004 [-0.11]
D.insta		-.583 [-1.71]*		-1.334 [-4.08]***		.529 [1.63]		-.028 [-0.07]
cts	.408 [23.56]***	.417 [23.96]***	.295 [17.33]***	.326 [20.57]***	.449[18.04]***	.456[18.19]***	.721[17.55]***	.721 [17.29]***

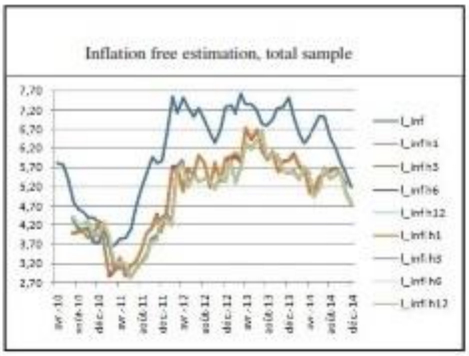
R2	0.483	0.499	0.576	0.651	0.658	0.685	0.581	0.581
F	(18, 16) 11.14***	(19, 15) 11.04***	(18, 76) 9.22***	(19, 7)12.02***	(18, 1)7.73***	(19, 1) 7.02***	(18, 2) 5.28***	(19, 2) 4.78***
N	179	179	96	96	36	36	48	48
Breusch-Pagan / Cook-Weisberg	14.42***	17.04***	0.21	0.54	4.65**	2.92*	0.91	0.93
Ramsey test F	(3, 157) 2.02	(3, 156)1.25	(3, 73) 0.12	(3, 72) 0.78	(3, 14) 0.32	(3, 13) 0.53	(3, 26) 2.00	(3, 25) 1.91
portmanteau	411.787***	356.117***	287.437	309.582	714.035***	902.668***	851.765***	845.253***

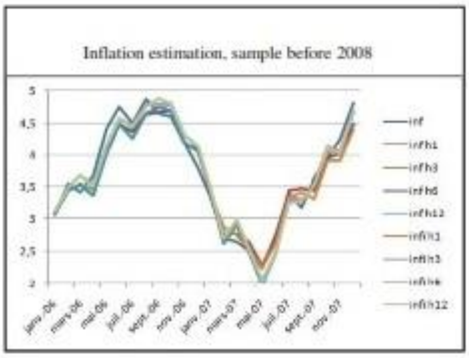
5d- inflation estimation graphics

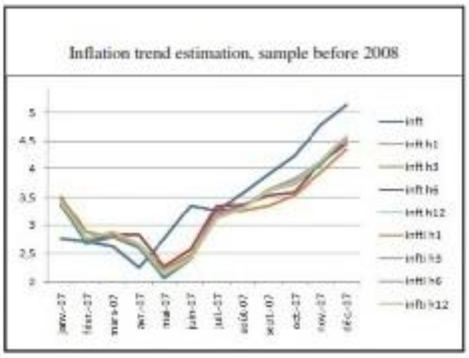


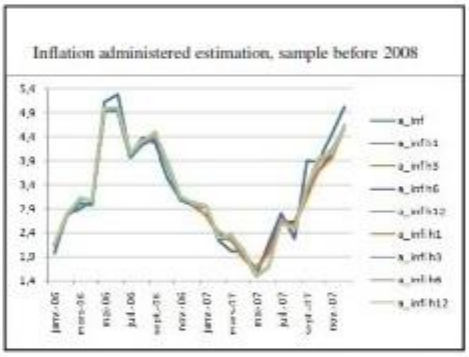


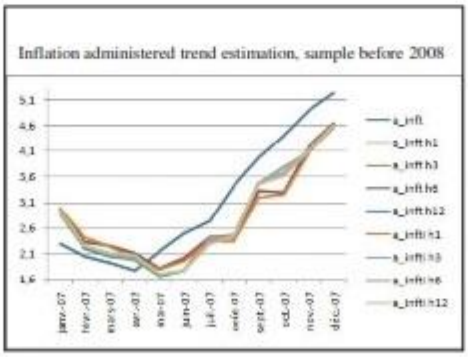


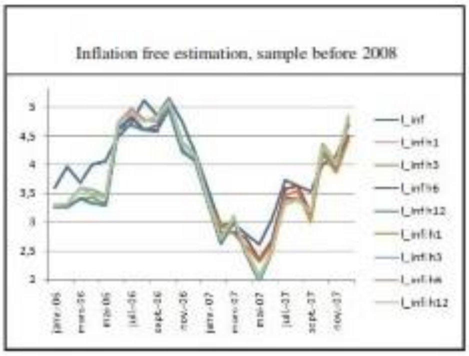


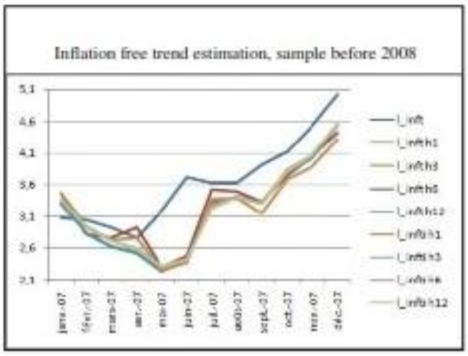

Inflation estimation, sample before 2008


Inflation trend estimation, sample before 2008


Inflation administered estimation, sample before 2008


Inflation administered trend estimation, sample before 2008


Inflation free estimation, sample before 2008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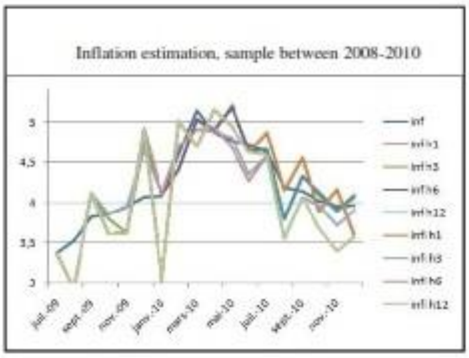
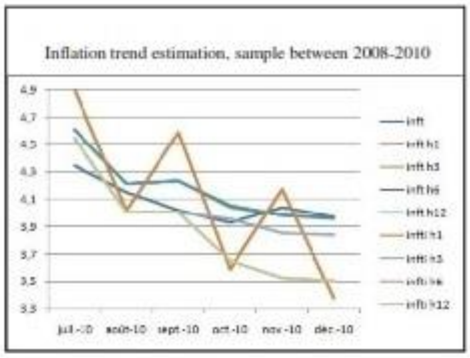
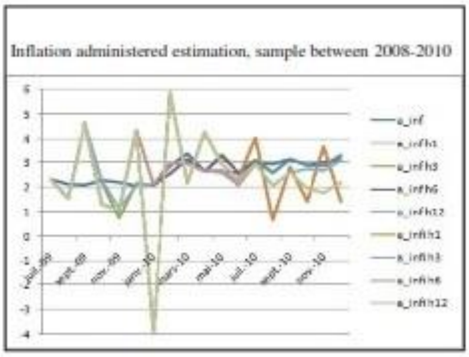
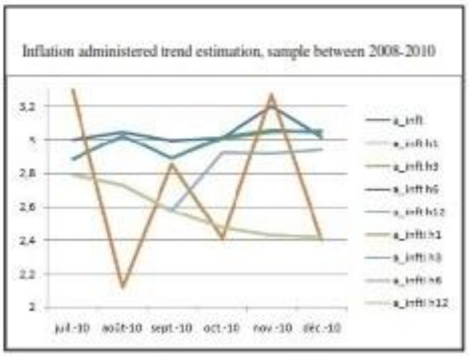
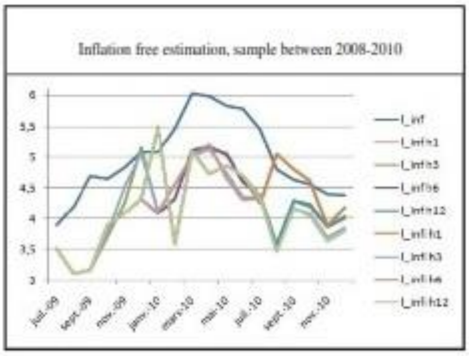
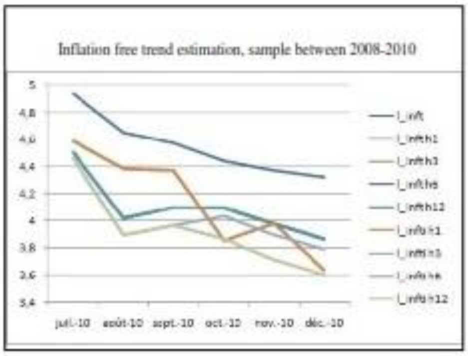

Inflation estimation, sample between 2008-2010

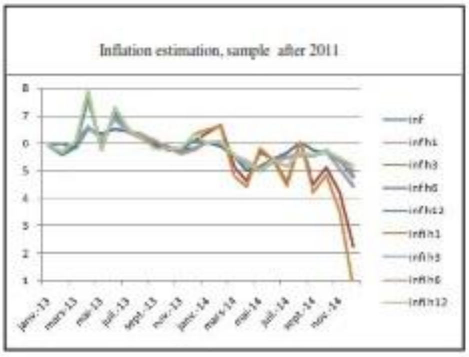

Inflation trend estimation, sample between 2008-2010

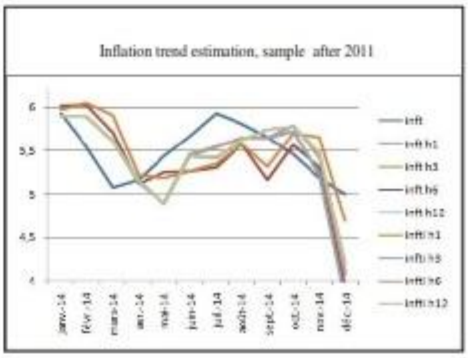

Inflation administered estimation, sample between 2008-2010

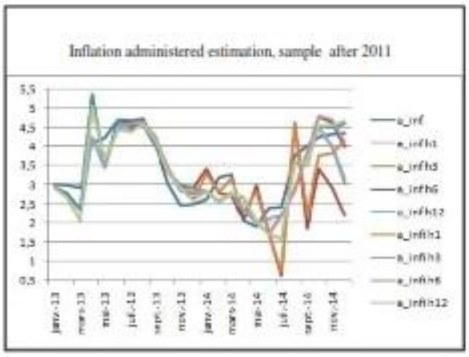

Inflation administered trend estimation, sample between 2008-2010

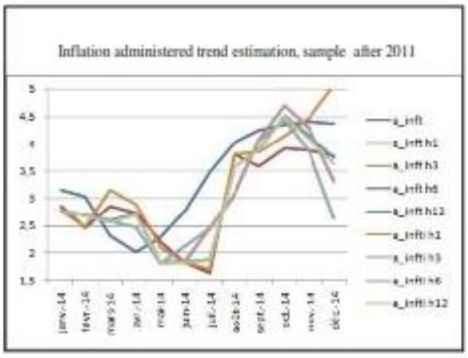

Inflation free estimation, sample between 2008-2010

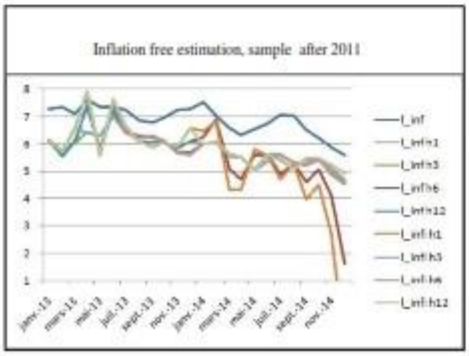

Inflation free trend estimation, sample between 2008-2010

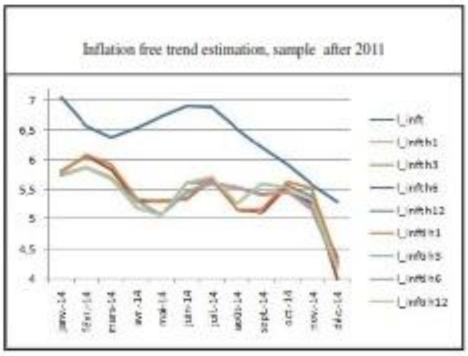

Inflation estimation, sample after 2011


Inflation trend estimation, sample after 2011


Inflation administered estimation, sample after 2011


Inflation administered trend estimation, sample after 2011


Inflation free estimation, sample after 2011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